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Development Document for Proposed Effluent Limitations Guidelines, New Source Performance Standards, and Pretreatment Standards for the Iron and Steel Manufacturing Point Source Category. Volume 4--Hot Forming Subcategory

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for

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NEW SOURCE PERFORMANCE STANDARDS,

and

PRETREATMENT STANDARDS

for the

IRON AND STEEL MANUFACTURING POINT SOURCE CATEGORY

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HOT FORMING SUBCATEGORY

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HOT FORMING SUBCATEGORY

SECTION I

PREFACE

The USEPA is proposing effluent limitations guidelines and standards for the steel industry. The proposed regulation contains effluent limitations for best practicable control technology currently available (BPT), best conventional pollutant control technology (BCT), and best available technology economically achievable (BAT) as well as pretreatment standards for new and existing sources (PSNS and PSES) and new source performance standards (NSPS), under Sections 301, 304, 306, 307, and 501 of the Clean Water Act.

This part of the Development Document highlights the technical aspects of EPA's study of the Hot Forming Subcategory of the Iron and Steel Industry. Volume I of the Development Document discusses issues pertaining to the industry in general, while other volumes relate to the remaining subcategories of the industry.

HOT FORMING SUBCATEGORY

SECTION II

CONCLUSIONS

This report highlights the technical aspects of EPA's study of the hot forming subcategory. Based on the current study and a review of previous studies, the Agency has reached the following conclusions:

1. The Agency has decided to combine all hot forming operations in one subcategory. The four major subdivisions of the subcategory - primary, section, flat, and pipe and tube - reflect significant differences in production process and wastewater flow. All hot forming wastewaters are basically similar in character.

2. The Agency is proposing BPT limitations for the hot forming subcategory that are identical to those promulgated in March, 1976. Those proposed limitations are well demonstrated throughout the industry.

3. The proposed BAT, BCT, NSPS, PSES and PSNS limitations and standards are based upon model plant flow rates (applied and discharge) determined from the expanded data base of the industry the Agency obtained as part of this study. While these model flow rates are different than those used to develop the limitations promulgated in 1976, they are more representative of the industry. Thus, the Agency believes industry-wide costs and effluent limitations based upon these flow data are more realistic and appropriate.

4. During this study, the Agency found that wastewaters from hot forming operations contain significant levels of conventional and toxic metal pollutants. Toxic organic pollutants were found at low levels in some hot forming wastes. As shown below, the Agency finds that discharges of these pollutants can be controlled by technologies that are well demonstrated throughout the hot forming subcategory.

	Effluent Loadings (Tons/Year)		
	Raw Waste	Proposed BPT	Proposed BAT and BCT
Flow, MGD	4,188	2,225	168
TSS	6,017,455	43,860	2,724
Oil and Grease	272,440	24,140	908
Toxic Metals	34,820	1,670	90

The Agency believes that extensive recycle of hot forming wastewaters considered as components of the BAT, NSPS, and Pretreatment alternative treatment systems is appropriate to minimize toxic pollutant discharges from hot forming operations.

5. EPA estimates that the industry will incur the following costs to comply with the proposed BPT, BCT, BAT, and PSES limitations and standards for facilities in place as of January 1, 1978.

Costs (Millions of July 1, 1978 Dollars)

	Investment			Total
	Total	In-place	Required	Annual
BPT	677.0	541.7	135.3	-103.7
BAT	535.5	100.8	434.7	110.8
TOTAL	1212.5	642.5	570.0	7.1

NOTE: BAT costs are in addition to BPT costs. BCT and PSES costs are included in the BPT and BAT costs.

It should be noted that the industry profile used for this study includes many facilities permanently shutdown during the past four years. Hence, the actual costs to be incurred by the industry as it stands today will be lower than those shown above for BPT and BAT.

6. The Agency developed the estimated investment and annual costs to achieve the proposed BAT and BCT limitations using a treatment model concept. This approach recognizes central treatment practices within the hot forming subcategory and more accurately depicts the expenditures that will be required to install the systems being considered. As part of this analysis, the Agency used co-mingling factors to account for typical cost savings achieved with central treatment facilities in this subcategory.

7. The technology identified for the control of conventional pollutants found in hot forming wastewaters was found to provide treatment at less cost than comparable POTW treatment. Hence, the Agency is proposing BCT limitations for all hot forming operations based upon recycle and filtration. This technology is fully compatible with the technology used to develop the proposed BAT limitations.

8. Proposed New Source Performance Standards and Pretreatment Standards are based upon the same technologies used to develop the proposed BAT and BCT limitations.

9. The Agency has concluded that by proposing effluent limitations for the same conventional pollutants (BCT) and toxic pollutants (BAT) for subcategories with compatible wastewaters, central treatment will be facilitated. For this reason, the Agency is proposing limitations for toxic metal pollutants in the hot forming subcategory which are the same as those proposed for limitations in the steelmaking, vacuum degassing, and continuous casting subcategories, among others.

10. As shown below (and in Table X-4), the Agency has found several hot forming operations which achieve zero discharge.

Subdivision	Number of Mills at Zero Discharge
Primary	3
Section	9
Flat	1*
Pipe and Tube	1

* Plant 0248B is not included in Table X-4 but has reported zero discharge.

The Agency is soliciting comments on whether zero discharge limitations and standards should be proposed at the BAT, BCT, and NSPS levels based upon the demonstrated performance of the above plants. These plants are achieving zero discharge using BPT, BAT, and BCT treatment model components. Hence, no additional costs beyond those required for BPT, BAT, and BCT would be necessary to achieve zero discharge.

12. Throughout this report, the Agency has addressed the applicable remand issues. Conclusions concerning these issues follow.

    a. The age of a plant has little or no effect upon the ease or cost of retrofitting pollution control equipment. Therefore, neither relaxed limitations for "older" plants nor retrofit cost allowances are proposed for hot forming operations.

    b. The alternative wastewater treatment systems for BAT, BCT, NSPS, PSES and PSNS involve the use of cooling towers which will consume about 20 million gallons of water per day (0.5% of total subcategory water usage). However, the amount of water consumed as a result of the installation of this technology is minimal when compared to the total amount of water used in this subcategory. The Agency concludes that the effluent reduction benefits associated with compliance with the proposed limitations justify the minor consumptive water losses, both on a national basis, and on an "arid" and "semi-arid" region basis. Plants located in arid and semi-arid regions have recycle systems for hot forming wastewaters. Additional details on these and other remand issues are presented in Volume I and in Section VIII of this report.

13. Table II-1 presents the treatment model flow and effluent quality data used to develop the proposed BPT effluent limitations for the hot forming subcategory, and Table II-2 presents these proposed limitations. Table II-3 presents the treatment model flow and effluent quality data used to develop the proposed BAT and BCT effluent limitations and the proposed NSPS, PSES, and

PSNS for the hot forming subcategory; Table II-4 presents these proposed limitations and standards.

TABLE II-1

BPT TREATMENT MODEL FLOWS AND EFFLUENT QUALITY-HOT FORMING SUBCATEGORY

Subdivision	Flow (GPT)	Monthly Average Concentrations (mg/l)(1)		
		TSS	O & G	pH (units)
1. Primary				
a. Carbon w/o scarfers	692	13	10	6-9
b. Carbon w/o scarfers	845	13	10	6-9
c. Specialty	1220	13	10	6-9
2. Section	2626	22	10	6-9
3. Flat				
a. Hot Strip and Sheet	4180	19	10	6-9
b. Carbon Plate	4000	10	10	6-9
c. Specialty Plate	9366	10	10	6-9
4. Pipe and Tube	1002	34	10	6-9

---

(1) Daily maximum effluent concentrations are three times the monthly average concentrations.

TABLE II-2

PROPOSED BPT EFFLUENT LIMITATIONS
HOT FORMING SUBCATEGORY

Subdivision	Effluent Limitations (kg/kkg of Product)(1) TSS	O & G	pH (units)
1. Primary			
a. Carbon w/o scarfers	0.0371	0.0288	6-9
b. Carbon w/o scarfers	0.0453	0.0352	6-9
c. Specialty	0.0654	0.0508	6-9
2. Section	0.242	0.110	6-9
3. Flat			
a. Hot Strip and Sheet	0.331	0.174	6-9
b. Carbon Plate	0.167	0.167	6-9
c. Specialty Plate	0.376	0.376	6-9
4. Pipe and Tube	0.142	0.042	6-9

---

(1) Daily maximum effluent limitations are three times the average limitations.

TABLE II-3

TREATMENT MODEL FLOWS AND EFFLUENT QUALITY HOT FORMING SUBCATEGORY

Subdivision	Flow Rates (gal/ton) BAT	BCT	NSPS	PSES	PSNS
1. Primary					
a. w/o Scarfers	90	90	90	90	90
b. w/o Scarfers	140	140	140	140	140
2. Section					
a. Carbon	200	200	200	200	200
b. Specialty	200	200	200	200	200
3. Flat					
a. Hot Strip & Sheet	260	260	260	260	260
b. Carbon Plate	140	140	140	140	140
c. Specialty Plate	60	60	60	60	60
4. Pipe & Tube	220	220	220	220	220

Pollutant$^{(2)}$	Monthly Average Concentrations$^{(1)}$ BAT	BCT	NSPS	PSES	PSNS
TSS	-	15	15	-	-
O&G	-	10*	10*	-	-
119 Chromium, Total	0.10	-	0.10	0.10	0.10
122 Lead	0.10	-	0.10	0.10	0.10
128 Zinc, Total	0.10	-	0.10	0.10	0.10
pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-

---

(1) Daily maximum concentrations are based upon the monthly average concentrations multiplied by the following factors:

Pollutants	Factor
TSS	2.67
Chromium, Lead & Zinc	3.00

Concentrations are expressed in mg/l unless otherwise noted.

(2) Concentrations shown apply to all hot forming subdivisions.

* Daily maximum concentration only, as shown.

TABLE II-4

PROPOSED EFFLUENT LIMITATIONS AND STANDARDS
HOT FORMING SUBCATEGORY

Pollutants		Effluent Limitations & Standards (kg/kkg of Product)(1)				
		BAT	BCT	NSPS	PSES	PSNS
1a.	Primary w/o Scarfers					
	TSS	-	563	563	-	-
	O&G	-	373*	373*	-	-
119	Chromium, Total	3.75	-	3.75	3.75	3.75
122	Lead	3.75	-	3.75	3.75	3.75
128	Zinc, Total	3.75	-	3.75	3.75	3.75
	pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-
1b.	Primary w/o Scarfers					
	TSS	-	876	876	-	-
	O&G	-	584*	584*	-	-
119	Chromium, Total	5.84	-	5.84	5.84	5.84
122	Lead	5.84	-	5.84	5.84	5.84
128	Zinc, Total	5.84	-	5.84	5.84	5.84
	pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-
2a.	Section-Carbon					
	TSS	-	1250	1250	-	-
	O&G	-	834*	834*	-	-
119	Chromium, Total	8.34	-	8.34	8.34	8.34
122	Lead	8.34	-	8.34	8.34	8.34
128	Zinc, Total	8.34	-	8.34	8.34	8.34
	pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-
2b.	Section-Specialty					
	TSS	-	813	813	-	-
	O&G	-	542*	542*	-	-
119	Chromium, Total	5.42	-	5.42	5.42	5.42
122	Lead	5.42	-	5.42	5.42	5.42
128	Zinc, Total	5.42	-	5.42	5.42	5.42
	pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-

TABLE II-4
PROPOSED EFFLUENT LIMITATION & STANDARDS
PAGE 2

	Effluent Limitations & Standards (kg/kkg of Product)(1)				
Pollutants	BAT	BCT	NSPS	PSES	PSNS
3a. Flat-Hot Strip & Sheet					
TSS	-	1630	1630	-	-
O&G	-	1090*	1090*	-	-
119 Chromium, Total	10.8	-	10.8	10.8	10.8
122 Lead	10.8	-	10.8	10.8	10.8
128 Zinc, Total	10.8	-	10.8	10.8	10.8
pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-
3b. Flat-Carbon Plate					
TSS	-	876	876	-	-
O&G	-	584*	584*	-	-
119 Chromium, Total	5.84	-	5.84	5.84	5.84
122 Lead	5.84	-	5.84	5.84	5.84
128 Zinc, Total	5.84	-	5.84	5.84	5.84
pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-
3c. Flat-Specialty Plate					
TSS	-	375	375	-	-
O&G	-	250*	250*	-	-
119 Chromium, Total	2.50	-	2.50	2.50	2.50
122 Lead	2.50	-	2.50	2.50	2.50
128 Zinc, Total	2.50	-	2.50	2.50	2.50
pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-
4. Pipe & Tube					
TSS	-	1380	1380	-	-
O&G	-	917*	917*	-	-
119 Chromium, Total	9.17	-	9.17	9.17	9.17
122 Lead	9.17	-	9.17	9.17	9.17
128 Zinc, Total	9.17	-	9.17	9.17	9.17
pH, units	-	6.0 to 9.0	6.0 to 9.0	-	-

(1) The proposed limitations and standards have been multiplied by 10^5 to obtain the values presented in this table.

Also, daily maximum limitations and standards are based upon the monthly average values multiplied by the following factors:

Pollutants	Factor
TSS	2.67
Chromium, Lead & Zinc	3.00

* Limitations and standards for oil and grease are on a maximum basis only as shown.

HOT FORMING SUBCATEGORY

SECTION III

INTRODUCTION

General Discussion

Hot forming is the steelmaking process in which hot steel, initially in solid ingot form or in intermediate shapes, is reduced in cross-section through a series of forming steps ultimately producing finished and semi-finished steel products. These products have numerous cross-sections, lengths and tonnages. While several different types of hot forming mills are in use today, the hot forming processes have been grouped into one subcategory with the following major subdivisions.

Primary Mills
Section Mills
Flat Mills (Plate and Hot Strip & Sheet)
Hot Worked Pipe and Tube Mills

Figure III-1 illustrates the sequences involved in hot forming operations.

Process wastewaters originating in the hot forming processes require treatment prior to discharge to receiving waters. Those wastewaters contain large amounts of suspended solids, oil and grease, and to a lesser extent, toxic metal pollutants. Toxic organic pollutants have been detected in some hot forming wastewaters. This report reviews wastewater treatment systems used at hot forming operations and includes model treatment systems and proposed effluent limitations and standards.

Data Collection Activities

The Agency sampled a total of 76 hot forming operations and obtained process information and wastewater quality data. The originally promulgated limitations for hot forming operations were based primarily upon data obtained through field sampling at 52 mills. Twenty-nine operations were sampled during the recent toxic pollutant survey (five operations were resampled). Table III-1 presents basic descriptions of each mill sampled.

The general methodology and approach for data collection is described in Volume I. Information regarding applied and discharge flow rates, treatment systems in use, mill production capacities and modes of operation were provided by the industry for 485 mills. Tables III-2 through III-7 summarize the information received for the respective hot forming processes.

In an effort to gather additional data, the Agency sent detailed data collection portfolios (D-DCPs) to thirty-one hot forming operations.

These questionnaires were designed to gather information on long-term effluent quality, treatment costs and other operating data.

Tables III-8 through III-12 summarize the data base for this report.

Description of Hot Forming Operations

Primary Rolling Mills

The hot forming, primary mill is the initial rolling step used in the production of a semi-finished product from solid hot steel ingots. Primary mills produce either blooms, slabs, or billets. Slabs are oblong shapes with cross-sections varying from 2" to 6" thick and 24" to 60" wide. Blooms are square or slightly oblong and are generally in the range of 6" x 6" to 10" x 12". Billets are square products that are generally less than 6" x 6". The preceding product dimensions are only reference sizes as many different cross-sections are produced with primary mills. Blooming, slabbing and billet mills are generally identified by the number of rolls or by the roll diameter and length such as a two high reversing mill or a 45" x 90" slabbing mill. Blooming mills may be coupled with billet mills so that the semi-finished bloom can immediately be rolled in the billet mill while it is still hot.

The operation of a typical primary mill operation is described below:

The hot steel ingots are transferred to the primary mills from soaking pit furnaces which uniformly heat the steel ingots to the desired rolling temperature, usually 1180 to 1340°C (2,156 to 2,444°F). The soaking pits also act as storage areas to compensate for production variations in the flow of steel ingots between the steelmaking facilities and primary rolling mills. The soaking pit furnaces are square, rectangular, or circular, fuel fired (i.e., oil, gas) refractory lined pits constructed with the top of the pits several feet above ground level. The soaking pits are usually arranged in rows and are installed in a building adjacent to or within the primary mill. The ingots are placed into the soaking pits in an upright position through openings in the top. Removable covers are used to close the pit openings. The pits are spanned by one or more cranes equipped with ingot lifting tongs for placing and removing the steel ingots. The crane removes the properly heated steel ingots and places them into an electrically driven ingot transfer car which automatically delivers the ingots to the primary rolling mill.

The mill approach tables transport the ingot to the front table or roller table in preparation for rolling. Some mills are equipped with a scale in the ingot receiving table or mill approach tables for weighing the ingot prior to rolling. Depending upon the type of primary mill, (i.e., reversing, tandem) the hot ingot is passed between the mill rolls and reduced in cross-section. In a reversing mill, the ingot is rolled through the same mill stand a number of times. A tandem mill is comprised of several mill stands such that the ingot is continuously rolled forward in one direction. Mill speeds are generally 200 to 400 feet per minute. During the rolling cycle, the ingot is transported to and from the mill stands by reversing rolls. The rolls are 12 to 21 inches in diameter and are spaced 2 to 3 feet apart. These roll tables are driven by line shafts. After the ingot is rolled to the desired size, the end of the bloom, slab, or billet is cut off or "cropped." A crop shear is also used to cut long rolled sections into several shorter pieces.

The industry is paying increased attention to the conditioning of semi-finished products as the demand for high quality steel products increases. The removal of surface defects from blooms, billets, and slabs prior to final rolling is a major consideration. Defects such as rolled seams, light scabs, and checks generally retain their identity during subsequent forming processes and result in products of inferior quality. These surface defects may be removed by hand chipping, machine chipping, scarfing, grinding, milling, and hot steel scarfing. The various mechanical means of surface preparation are common to all metal working and machine shop operations. Scarfing is a process of supplying streams of oxygen as jets to the surface of the steel product under treatment, while maintaining high surface temperatures, which results in the rapid oxidation and localized melting of a thin layer of the metal. The process may be done manually (involving the continuous motion of an oxyacetylene torch along the length of the product) but in recent years automatic hot scarfing has come into wide use. The scarfing machine is located at the mill run out tables or at the shear approach tables.

The automatic hot scarfing process first uses flames generated by the burning of oxygen and fuel (either acetylene or natural gas) to preheat the semifinished product surface to steel melting temperatures. A continuous stream of pure oxygen is then directed onto the reheated steel surface and the semifinished product is then moved at a controlled speed through the scarfing machine. The oxygen applied to the entire surface of the billet, bloom or slab oxidizes the steel surface, and removes a surface layer to a predetermined depth, typically not in excess of 1/8 inch.

The automatic scarfing machine scarfs steels at speeds between 50 to 200 feet per minute. A typical operating cycle for an automatic hot scarfer is shown below.

a.	Position product	7 seconds
b.	Close scarfing units around product	3 seconds
c.	Preheat product surface	5 seconds
d.	Scarf (Oxygen on)	30 seconds
e.	Retract scarfing units	5 seconds
	Total	50 seconds

The scarfing machine is mounted on a motor driven carriage on rails and can be moved in and out of the primary rolling mill run out table line. The removal of the surface metal results in a continuous production of molten slag. The quantity of slag generated depends upon the section size and depth of cut and is removed by high pressure water sprays.

Scarfing also results in appreciable quantities of smoke. The quantity and density are dependent upon the type of steel, oxygen pressure, and the efficiency of slag water jets. Hoods are placed over the scarfing roll table to collect the fumes which contain solids consisting mainly of iron oxides with traces of the alloying elements found in the steel being scarfed. The solids are submicron in size, and are produced at an approximate rate of 36 grains per pound of product surface metal removed.

The exhaust gases are comprised mainly of air with some quantities of CO and CO_2 (2%). These gases are saturated at a temperature of 60°C (140°F) when exiting the scarfer hood. Because these gases are saturated, three types of gas cleaning equipment systems are generally used:

1. Wet Precipitator - Intermittent Spray Wash
2. Wet Precipitator - Continuous Wash
3. High Energy Venturi Scrubber

The wet precipitator - intermittent spray wash uses a spray water wash on a time cycle to cleanse the fume residue which is collected dry on the precipitator plates. The wet precipitator - continuous wash uses a continuous water wash to cleanse the collected fume residue from precipitator plates. The high energy scrubber requires 45 to 50 (inches water column) pressure drop to clean the gases, and requires scrubbing water at a rate of 7 to 12 gallons per 1000 cubic feet of saturated gas exhausted. The effluent wastes from these gas cleaning systems are generally discharged to the primary mill wastewater treatment system. At many mills, scarfer wastewaters are recycled continuously with only a blowdown discharged to the primary mill treatment system.

Many primary mills are being replaced with continuous casting operations referred to as billet, bloom or slab casting machines. The casting machines, in turn, furnish the steel slabs or blooms to the section mills.

See Figures III-2 and III-3 for primary rolling mill process flow diagrams.

Section Rolling Mills

The section rolling mill takes the semi-finished product from the primary mill and produces either an intermediate finished product called a billet, which is further reduced in other finishing mills, or rolls the bloom directly to a finished product. Most billets are rolled directly from the primary mill without reheating furnaces but some steel plants employ furnaces between the primary and section mills. The older primary and section mills generally do not have reheat furnaces since the grades of steel produced do not require the restricted rolling temperatures as do the newer steel types. New facilities have the capability to bypass the reheat furnaces depending upon the grade of steel being rolled.

Reheating is necessary for section operations whenever the temperature of the metal being worked falls below that temperature required to maintain plasticity. Reheating furnaces are either batch or continuous. Batch furnaces are those in which the charged material remains in a fixed position on the hearth until heated to rolling temperature. Continuous furnaces are those in which the charged material moves through the furnace and is heated to rolling temperature as it progresses toward the exit. Batch furnaces vary in size from those with hearths of only a few feet square to those 20 ft in depth by 50 ft long. Some modern continuous furnaces have hearths 80 to 90 feet long.

Automatic hot scarfing is used at five section mills. The automatic hot scarfer used for the section mill operations is the same as described for primary rolling mills.

The intermediate and finished products produced from section mills include rails, joint bars, I-beams, channels, angles, wide flanged beams, H-beams, sheet piling, and billets which are further processed into tube rounds, bar and rod, wire, and numerous special sections. Following is a brief description of the various section mills.

Billet Mills

There are several types of billet mills. One is the three high mill with lifting and tilting tables. This mill consists of three rolls mounted on a single roll housing stand, one roll above the other. Billets are rolled in one direction between the bottom and middle rolls and in the opposite direction between the middle and top rolls. The lifting and tilting tables move the billets to the two different pass levels. Mills of this type can produce only a limited number of product sizes.

Another billet mill design is the cross-country mill which is composed of several roll stands so arranged that the billet is never in more than one stand at the same time. The roll stands may be placed side by side and the billet transferred to the various roll tables. The direction of rolling can be reversed in each stand. The cross country billet mill is faster and more flexible than the three high mill and can roll a complete range of billet sizes.

A third billet mill design is the continuous billet mill in which a series of roll stands continuously reduce the billet in size, rolling in only one direction through the mill stands. Continuous billet mills have high production rates and minimal scrap losses since blooms of any length can be rolled.

Following the billet mill operation, the product is cut to the desired finished piece length. The cutting is accomplished by stationary shears, movable gang shears, flying shears, flame cutting, or saws. Shears are faster but distort product ends while flying shears are used on small billets to eliminate long tables and transfers. Saws and flame cutting eliminate distorted ends but are slower and require maintenance and expensive fuels.

The billets are subsequently transferred to bar mills or merchant mills for processing into finished products. The billets are heated to rolling temperature in continuous reheat furnaces. The billets are fed into one end and moved through the furnace by a billet pusher. A walking beam furnace is sometimes used to eliminate the slide marks on the underside of the billets. A billet ejector, normally a pusher bar type, pushes the end billet out of the side of the furnace. A shear then cuts the heated billets to size or removes bent ends prior to conveying the billet to the bar mill.

Bar Mills

Modern bar mills are normally arranged in a cross-country design or continuous design. Both types have in-line roughing stands, however, the cross-country mill has side by side intermediate and finishing stands whereas the continuous mill has all stands in-line. The continuous mill is more efficient for production runs but requires more space and individual motors on each stand. Descaling and cooling water sprays are employed at the mill stands with the discharge draining to trenches under the mill into collection systems.

Various products are rolled in the bar mills such as angles, channels, flats, other small sections, rebar, window sash, fence posts, rounds, wire, and flat narrow strips. These products are sheared to proper length, marked for identification, sometimes straightened, bundled or coiled, and weighed for shipment or further processing.

Rail Mills

Rails are formed from heated blooms in various mill arrangements, but the forming generally takes place in three steps or stages. The first stage is the roughing stage where the bloom is reduced in section and elongated. High pressure sprays are used at the discharge of the roughing stands for scale removal. The second, or intermediate stage, proceeds with the forming of the rail and involves a combination of slabber, dummy, former, edger, and leader passes, depending upon the mill layout. The third stage is the finishing pass which then completes the formation of the desired rail section.

The rails are conveyed from the finishing stand on a runout table to hot saws which cut the product to the standard 39 ft rail length. After sawing, the rails are stamped, cambered, and weighed before they are advanced to cooling beds. Rails intended for railroad service must be control cooled in containers to prevent the formation of internal thermal ruptures or cracks. After cooling, the rails are conveyed to finishing operations which consist of inspection, removal of saw burrs, straightening, drilling, grinding of ends, leveling, inspection, classification, and painting.

Rail-Joint Bars

Joint bars are rolled from heated blooms or billets similar to rails. Additional passes are required if the joint bar has a depending flange, or long toe. The finishing operation consists of hot-working and oil-quenching the joint bars. In this operation the product is cold sheared to length and then reheated for hot-working which consists of punching, slotting, straightening, and quenching in an oil tank.

Structural and Other Section Mills

Structural sections include standard items such as I-beams, channels, angles, and wide-flange beams, and special sections such as zees, tees, bulb angles, and car-building center sills. Other sections include miscellaneous shapes such as sheet piling, tie plates, and cross ties.

Blooms are heated in a continuous reheat furnace and then conveyed to the roughing, intermediate, and finishing stands. Passes in actual use range from fifteen roughing and nine intermediate on sections requiring heavy overall work, to two fine roughing and three intermediate on the sections requiring a minimum of work. In all cases, the intermediate passes are followed by a single finishing pass. In rolling wide-flange beams it is customary to roll a bloom which has, as nearly as possible, the same proportions as the finished beam.

Rolled material from the structural mills is delivered by a roller table to the hot saw. This equipment consists of a circular saw over which large quantities of cooling water are passed to maintain the cutting edges. Cuts are usually made at the hot saw to remove the crop ends, to part the usable material into lengths that can be handled for further processing, and to provide short test pieces. The shapes are then cooled on a cooling bed. After cooling, the shapes are conveyed to the finishing area where they are straightened, cold sheared or cold sawed, and inspected prior to separating and assembling for shipment.

Merchant-bar, rod, and wire mills produce a wide variety of products in continuous operations ranging from shapes of small size through bars and rods. Mill designation and product classification are not very well defined within the industry. In general, the small cross-sectional area and very long lengths distinguish the products of these mills. Raw materials for these mills are reheated billets. Many older mills included hand looping operations in which the material is passed from stand to stand manually. Newer mills use mechanical methods of transferring the material from stand to stand. As with other rolling operations the billet is progressively squeezed and shaped to the desired product dimensions in a series of rolls. Water sprays are used throughout the operation to remove scale.

See Figure III-4 for the process flow diagram for section rolling mills.

Plate Mills

Plates are classified according to size limitations to distinguish them from sheet, strip, and flat bars. According to this classification, plates are generally considered to be those flat hot-rolled finished products that are more than 8 inches wide and generally 0.23 inches or more thick, or over 48 inches wide and at least 0.18 inches thick. The sequence of operations for plate mills is reheating of slabs, descaling, rolling, leveling, cooling and shearing. Most plate mills use continuous heating furnaces. Descaling in modern plate mills is accomplished by hydraulic sprays impinging on both top and bottom surfaces and operating at pressures up to 1,500 lbs per sq. in. Temperature variation in the plate from the front to the back is a problem of particular importance in rolling plates, as is the care that must be exercised in cooling the rolled product so as to avoid distortion.

The basic operation of a plate mill is the reduction of a heated slab to the weight and dimensional limitations defining plates. This is accomplished by heating the slabs, descaling, rolling them to plate, leveling, or flattening, cooling, and shearing to the desired size.

Slabs are received from slabbing mills or continuous casters and then stored in slab yards. Slabs are removed from storage by overhead cranes and placed on a charging table at the entry end of the reheat furnaces. The slabs are moved through a continuous type reheat furnace by pushing the last piece charged with a pusher at the charging entry end of the furnace. The reheat furnace heats the slabs to a rolling temperature of approximately 1,220°C (2,230°F). As each cold slab is pushed into the furnace against the line of material already in the furnace, a heated piece exits the furnace. The heated slab is discharged from the furnace by gravity upon a roller table which feeds the mill.

Heated slabs are conveyed on a roller table to a scale-breaker mill stand. As the slab leaves the scale-breaker, primary descaling is completed with top and bottom high pressure hydraulic water sprays operating at 1,000 psi to 1,500 psi. The scale-breaker and water sprays flush away iron oxide or mill scale which forms on the surface of the hot slabs. Generally, about 4% of the spray water evaporates and the balance is discharged through a trench under the mills to a mill scale and wastewater collection system. Mill scale generation may amount to 1.5-4% of the steel production. During the rolling operations, cooling water is sprayed externally over the table and mill stand rolls. Additional lubrication between product and mill stand rolls is provided at intervals by sprays of water soluble oil.

The descaled slabs are conveyed on roller tables to the plate mill. There are various types of plate mills such as three high mills, four high reversing mills, tandem mills, semi-continuous and continuous mills. In each of the various plate mills, the heated slab is reduced to the desired plate size. Cooling water, spray water, and water soluble oil is sprayed externally over the mill stand rolls. Hydraulic sprays on both sides of the mill stands, operating at high pressure, are employed for top and bottom secondary scale removal. The plates are conveyed on a run-out table to a leveler. A portion of the run-out table is equipped with a series of cooling sprays. After leveling, the plates are cooled uniformly to avoid localized stresses which would set up permanent distortions. After cooling, the plates are conveyed to end and side shears where they can be cut to proper size and then transferred to a shipping storage building, or sent to heat treating furnaces.

More specific details of a plate mill operation are presented in Figure III-5.

Hot Strip Mill

The continuous wide hot strip mill uses slabs that are reheated to rolling temperatures (2000-2400°F) in continuous reheat furnaces. Slabs are provided either from a storage yard or are delivered hot directly from the slabbing mill, thus bypassing the reheat furnaces. Slab casting machines are also used to produce slabs. Slabs are generally provided in sizes of 2 to 7 inches thick, one to five feet in width and up to twenty feet in length.

The basic operation of a hot strip mill is the reduction of slabs to flat strip steel in thicknesses of 0.04 inches to 1.25 inches, widths of 24 inches to 96 inches, and lengths up to 2,000 feet. The modern hot strip mill produces a product which may be up to 96 inches wide, although the most common width in newer mills is 80 inches. The product of the hot strip mill may be sold as produced, processed in cold reduction mills, and plated or coated.

The continuous wide hot strip mill rolling train consists of a roughing scale breaker stand, several roughing mill stands, a finishing scale breaker stand, several finishing mill stands, a run-out table and coilers. Motor driven roll stands convey the hot slabs from the reheat furnaces to the mill stands and also from mill stand to mill stand. If the mill is to produce strip or sheets greater than the maximum width of available slabs, the first roughing stand acts as a broadside mill stand in which the width of the slab is increased in a single pass by cross rolling. Turntables ahead and following the roughing stand rotate the slab 90° for cross-rolling. The roughing roll stands are separated from the finishing roll stands by a holding table while the finishing stands are a closely grouped, tandem rolling train of scale breakers and finishing mill stands. High pressure (500-1500 psi) water sprays which are used to remove scale from the hot slabs are located after the two scalebreaker stands and the roughing stands. Roll stand spray cooling water is provided for cooling of each roll in the stands.

Following the last finishing stand, there is usually a flying shear for cutting the rolled product into sheets. A flying shear moves with the strip as it cuts the strip into sheets. As the hot strip exits the last finishing stand it is carried over long tables called run-out tables. Mill speeds approximate 600 meters/minute (1970 feet/minute). Two or more coilers, which are located at the end of the run-out tables, serve to coil the hot strip when continuous long lengths are required. If sheets are being cut by the flying shear, the coilers do not operate. Instead, the steel sheets pass over the coilers onto a sheet piler at the end of the run-out tables.

An alternate arrangement of a hot strip mill uses reversing roughing stands with tandem continuous finishing roll stands. This arrangement allows for more passes in one roughing stand, thus decreasing the length of the mill. However, mill production capacity is less than the tandem mill arrangement.

A rotary crop shear is located between the roughing and finishing mill stands so that the front and rear ends of the strip can be squared off before finishing. Scrap strip steel from the hot strip mill is known as "cobble."

Strip product is conveyed from the finishing stands to a run-out table with automatic spray water coolers. The cooling water sprays continuously cool the product on the run-out tables. Similar to the wastewater from the mill stands and tables, the spray water drains through a trench under the mill stands to the wastewater collection system. The coiled strip product is conveyed to storage for shipping or further processing.

More specific details of a hot strip mill operation are presented in Figure III-6.

Combination Sheet, Strip and Plate Mills

Several hot forming-flat rolling mills produce a variety of finished products including sheet, strip and plate. Product classification is based upon thickness and width as shown by the following:

	Thickness Greater Than		
Width	0.05"	0.230"	0.299"
6"-12"	Strip	Plate	Strip
12"-48"	Sheet	Plate	Sheet
Over 48"	Sheet	Plate	Plate

Some mills are capable of producing all of the above products. Because of the similarities between combination mills and strip mills, the combination mills have been included in the hot strip data base for the purpose of developing effluent limitations.

Pipe and Tube Mills - Hot Worked

Butt-Welded Pipe

Welded tubular products are classified as butt-weld. Butt-weld pipe or tube is made from a hot rolled strip, with square or slightly beveled edges, called skelp, the width of which corresponds to the circumference of the pipe, and the gauge to the wall thickness. By heating skelp to its welding temperature in a reheat furnace and drawing it through a die or roll pass, the skelp is bent into a cylindrical shape and its edges pressed firmly together into a butt-weld, thus forming a pipe. The butt-welding process is used to manufacture pipe, 1/8 inches to 4 inches in diameter. Skelp is conveyed from storage and charged into a reheating furnace, welded in a welding stand, and finished on finishing machines.

The skelp is charged into a continuous reheat furnace. Modern mills use skelp strip in coils to feed continuous butt-welding operations. The skelp is fed into a threading machine which feeds it through the furnace. Once the leading end is in the forming and welding unit, the threading rolls release the skelp. The leading end of the next skelp strip is welded to the trailing arm of the first strip by a flash type skelp welder, prior to entry into the reheat furnace. The skelp strip exits from the furnace into a continuous forming and welding mill. The forming stand rolls then force the skelp into a welding stand, where the edges are pressed firmly together. The last stands of the mill contain reducing rolls which provide for reduction of diameter and a resultant change in wall thickness. A rotary flying saw cuts the continuous pipe into lengths. The cut lengths are reduced to the required hot size on a sizing mill. The hot pipe is delivered to a cooling bed and then passes to a water bosh tank for fast cooling. Conveyors feed the pipe to straighteners in the finishing bay. Details of a typical operation are depicted in Figure III-7.

Seamless Tubular Products

Seamless tubular products are made by two processes; piercing and cupping. In the piercing process, a solid round bar or billet is heated, pierced and afterwards shaped to the desired diameter and wall thickness. This process is used today for most seamless pipe products. The cupping process is used primarily for the manufacture of special tubes and gas cylinders. A circular sheet or plate is forced by successive operations through several pairs of conical dies until the plate takes the form of a tube, or cylinder with one end closed. Details of a typical mill are shown in Figure III-8.

The production of seamless pipe and the mills required for this operation vary depending on the diameter of the pipe product. The steps required to produce pipe up to 4 inches in diameter consist of heating a solid billet, piercing, plug rolling, reeling, reheating and reducing or sizing. The production of pipe up to 16 inches in diameter is similar except a second piercing and reheating operation is required. Pipe up to 26 inches in diameter is produced in a manner similar to the preceding 16 inch operation except for the addition of a rotary rolling mill and a third reheating operation.

A solid bar or billet of the proper length and diameter to make the size and weight of the tube desired is heated to rolling temperature of approximately 1,230°C (2,250°F). The heated billet is transferred in a horizontal trough to the piercing mill, which consists of two contoured horizontal rolls and a piercing mandrel. The roll surfaces are contoured so that, in the horizontal plane through the centerline of the pass, the space between the rolls converges toward the delivery side and then diverges to form the pass outlet. The point of the centerline of the pass is determined by guides between the rolls. Between these guides in the pass outlet, a projectile shaped piercing mandrel is held in position on the end of a water-cooled mandrel support bar, located on the delivery side of the mill. The heated billet is drawn over a mandrel, thus forming a hollow shell. As the billet is drawn and compressed, the spreading of the metal sets up a lateral tension which may cause its particles to be drawn away from the center, and for this reason the nose of the mandrel is at a point preceding the forming of the cavity to insure a smooth inner surface. The initial piercing produces a hollow tube with a comparatively heavy wall. The second piercing mill further reduces the wall thickness and increases the diameter and length of the piece required in the production of large diameter product.

In the plug mill, a plug on a support bar is rammed into the end of the shell, which is then drawn over the plug by revolving rolls, slightly reducing its wall thickness and increasing its diameter and length. In the rotary rolling mills, which are used for large diameter pipe, conical rolls grip and spin the pipe, feeding it forward over a large tapered mandrel, thereby decreasing the thickness of the pipe wall and increasing its diameter. The length of the tube remains essentially unchanged by this operation.

The reeling machine, consisting of rolls and a mandrel similar to the piercing mill, reduces the thickness of the wall slightly. This reduction has the effect of burnishing the inside and outside surfaces of the tube and slightly increasing its diameter. After reeling, the tube is reheated and conveyed to the sizing rolls, the grooves of which are slightly smaller than the reeled tube. This reduces the tube diameter which insures uniform size and roundness throughout its length. After sizing, the product is straightened, its ends cropped, inspected, and finished as required for its eventual use.

The properties of hot rolled seamless pipe may be improved by cold working. One method is the seamless pipe method in which the hot rolled pipe (after cooling) is conveyed to a cold expander mill. The hot rolled pipe is dropped into an expander trough, clamped with one end held firmly against a backstop. A long ram is positioned at the opposite end of the pipe and an expander plug is forced through the pipe under extreme pressure. The plug is lubricated through the ram head with a water soluble oil. After cold expansion, the seamless pipe enters a rotary straightener after which it is hydrostatically tested. Cold working the pipe increases its yield strength and generally improves the product. The cold worked operations are reviewed in the cold forming subcategory.

TABLE III-1

SUMMARY OF SAMPLED PLANTS
HOT FORMING SUBCATEGORY

Sample Code	Plant Reference Code	Type of Mill
		PRIMARY MILLS
E	0020B	Slab
L-2	0060	Slab
A-2	0112B(01 & 02)	Bloom Mills (2)
B-2	0112B-03	Slab
081	0176	Bloom
R	0240A	Bloom
H	0248A	Bloom
D	0248B	Slab
K	0256K	Slab/Bloom
M	0432J	Slab/Bloom
082(1)	0496(140"only)	Slab/Rough Plate
082	0496(140"206" in tandem)	Slab/Rough Plate
Q	0684D	Bloom
C-2&088(Revisited)	0684H	Bloom
083	0860H-03	Slab/Bloom
D-2	0946A	Bloom
		SECTION MILLS
A-2	0112B	Rail Mill
D-2	0291C	Nos.2,5 and 6 Mills
E-2	0196A(09&10)	Bar Mill & Rod Mill
F-2	0384A-06	12" Bar Mill
G-2	0650A(01&02)	10"&12" Mills
H-2	0432A-04	Rod Mill
I-2	08560	Rod Mill
C	0424(01-03)	Bar Mills(3)
H	0248A	Merchant Mill
K	0256K	Bar Mill
M	0432J	Billet Mill
O & 081(Revisited)	0176(01-03)	Bar Mills(3)
083	0860H(02&03)	34" & Rod Mills
087	0432-02	14" Mill

TABLE III-1
SUMMARY OF SAMPLED PLANTS
HOT FORMING SUBCATEGORY
PAGE 2

Sample Code	Plant Reference Code	Type of Mill	Steel Type
088	0684H-02	34" Mill	Specialty
088	0684H(01,03,05,06,07)	36",32",14",10",11" Mills	Carbon
		HOT STRIP & SHEET MILLS	
O	0176	#4 Hot Mill	Specialty
E	0020B	HSM	Specialty
D	0248B	HSM	Specialty
J-2	0860B-01	84" HSM	Carbon
L-2	0060	Hot Strip & Sheet Mill	Carbon
M-2	0384A-02	80" HSM	Carbon
N-2	0396D-02	#4 HSM	Carbon
086	0112D-02	80" HSM	Carbon
087	0432A	44" HSM	Carbon
		PLATE MILLS	
F	0856H-03	160" Plate Mill	Specialty
K-2	0868B	160" Plate Mill	Carbon
082	0496(01&03)	140",112"/120",and 140"/206" Mills	Carbon
082	0496(02&04)	112"/120" and 140" Mills	Specialty
083	0860H-01	30" Plate Mill	Carbon
086	0112D-01	160" Plate Mill	Carbon
		PIPE & TUBE MILLS	
E-2	0196A-01	Seamless	Carbon
GG-2	0240B-05	Seamless	Specialty
II-2	0916A	Butt Weld	Carbon
JJ-2	0728	Butt Weld	Carbon

TABLE III-1
SUMMARY OF SAMPLED PLANTS
HOT FORMING SUBCATEGORY
PAGE 3

Sample Code	Plant Reference Code	Type of Mill	Steel Type
KK-2	0256G	Butt Weld	Carbon
087	0432A-01	Butt Weld	Carbon
088	0684H	Seamless	Carbon

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(1) Plant 082 consists of a 206" and a 140" set of mill stands which are part of the same line, and can work as a single unit or as separate mills. The line was sampled while operating in two different configurations as shown. This same complex also functions as a Hot Forming - Flat/Plate Mill.

TABLE III-2

GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0020B	Slabs	SS & Elects	1948	4065	1594	1594	1594	PSP	SSP,SS,SC	OT	Direct	No
0060	Slabs	C.S.	1969	8537	2024 (1012)	1012	210	PSP,SS,	CNT,FLL, FLP,CL, CT,VF	RUP-50 RET-10 RTP-39.6 BD-0.4	Direct	Yes
0060B 01	Slabs	C.S.	1953 [1966]	5505	IR	IR	IR	IR	IR	RTP(UNK) RET(UNK)	Indirect	No
0060B 02	Blooms	C.S.	1964	1653	IR	IR	IR	IR	IR	RTP(UNK) RET(UNK)	Indirect	No
0060D	Blooms, Slabs	Elect. Steel	1910 [1958]	2268	254	254	4	PSP	SSP,FLL, FLA,CL SL	RTP-99 BD-1	Direct	No
0060F 01	Slabs & Blooms	C.S.	1962	6195	2045	232.4	UNK	PSP,SSP, SC,SL SS	-	RUP-89 RTP-UNK BD-UNK	Direct	Yes
0060F 02	Blooms	C.S.	1944	2070	IR	IR	IR	IR	-	UNK	Direct	Yes
0060G	Blooms	C.S.	1954	2868	4895 (1004)	4895	685	PSP,SL SS,SCR	-	RUP-86 BD-14	Direct	Yes
0060I	Blooms	SS	1941	495	3782	3782	0	PSP	SSP,CT, SS	RTP-100	Zero Discharge	No
0068	Blooms	C.S.	1905 [1966]	1407	IR	IR	IR	IR	-	RTP(UNK)	POTW	Yes
0088A	Blooms	SS	1942 [1958]	180	Zero	Zero	Zero	IR	IR	N/A	N/A	No
0088D	Blooms	HSLA	1959	2058	6339	41.3	41.3	-	NL,FLP, CL,SS,VF	RUP-99 BD-1	Direct	Yes
0112 01	Blooms	C.S.	1907 [1955]	3966	IR	IR	IR	PSP,SSP, SS	CNT FDS	OT	Direct	No

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0112 02	Blooms	C.S.	1907	3633	IR	IR	IR	PSP,SSP, SS	CNT FDS	OT	Direct	No
0112 03	Blooms	C.S.	1917			NOT IN OPERATION						
0112 04	Blooms, Slabs	HSLA	1914	870	IR	IR	IR	-	PSP,SSP SS,GF FDS	RUP(UNK) RTP(UNK) BD(UNK)	Direct	Yes
0112A 01	Slabs & Blooms	C.S.	1926 [1954]	4641	1179	559	559	PSP	-	BD-47 RUP-53	Direct	Yes
0112A 02	Slabs	C.S.	1930	6861	336	336	336	PSP,SSP SS	CNT F	RET-100	Indirect	Yes
0112A 03	Slabs	C.S.	1957	10,035	2296	574	574	PSP,SS, SCR	CNT,NL, FLA,FLP, SL	RUP-75 BD-25	Direct	Yes
0112B 01	Blooms	C.S.	1926 [1952]	1971	IR	IR	IR	PSP	F	RTP(UNK)	Direct	No
0112B 02	Blooms	C.S.	1928	3963	IR	IR	IR	PSP	FDS T	RTP(UNK)	Direct	Yes
0112B 03	Slabs	C.S.	1961	10,974	IR	IR	IR	PSP	FDS(UNK)	RTP(UNK)	Direct	Yes
0112D	Slabs	C.S.	1969	11,619	IR	IR	IR	PSP,SSP, SS	CNT,FLP, NL,CL, SL NW	RTP(UNK)	Direct	Yes
0112E	Blooms	C.S.	1914 [1954]	4515	IR	IR	IR	PSP,SS	CNT SSP,SL	RUP(UNK)	Direct	No
0112F	Slabs & Blooms	C.S.	1947	1857	IR	IR	IR	PSP,SS	CNT GL,SSP,CT	RUP(UNK) RTP(UNK)	Direct	Yes

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0112G	Slabs & Blooms	C.S.	1958	1575	IR	IR	IR	PSP,SS	CHT SSP	RTP(UNK)	Direct	No
0176	Blooms	UNK	1917/18 [1969]	285	1011	1011	35.8	PSP	TP,CL,CT	RTP-96 BD-4	Direct	No
0188A	Blooms	C.S.	1959	825	5585	5585	5585	PSP,SS	SSP,FDS	OT	Direct	No
0188B	Blooms	C.S.	1940 [1961]	804	3656	3656	1846	PSP	SSP,CT	RTP-49.5 RET-49.5 BD-1	Direct	No
0196A 01	Rail Mill	**	**	**	**	**	**	**	**	**	**	
0196A 02	Slabs & Blooms	**	**	**	**	**	**	**	**	**	**	
0240A	Blooms	HSLA	1942 [1957]	2322	IR	IR	IR	PSP	SSP SL,SS	UNK	Direct	Yes
0248A	Blooms	AT	1912 [1958]	2433	4735	4735	459	PSP	SCR, SSP,SS	RTP-90.3 BD-9.7	Direct	Yes
0248B	Slab	SS	1960	1500	7776	7776	96	PSP	SSP, SCR,FLP CL,SS,CT	RTP-98.8 BD-1.2	Direct	Yes
0248C	Blooms	SS	1962	415	2186	2186	146	PSP	A,NC,FLF FLP CL	RTP-93.3 BD-6.7	Direct	No
0256C	Slabs	C.S.	1952 [1966]	2526	IR	IR	IR	PSP	SL,SS	RTP(UNK)	Direct	No
0256K	**	**	1973	**	**	**	**	-	**	**	**	
0320 01	Blooms	Alloy	1936	1500	IR	IR	IR	PSP	SS NC,GC,CL SL	OT	Direct	No

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0320 02	Slabs	C.S.	1969	9600	2175	1800	375	PSP	MC,SS, GC,CL, SL	RUP-83 BD-17	Direct	Yes
0384A 01	Slabs & Blooms	C.S.	1917 [1953]	3864	7483	7483	7483	PSP	SSP,SS SL	OT	Direct	No
0384A 02	Blooms & Slabs	C.S.	1936 [1952]	5034	2613	2613	2613	PSP	SL SS	OT	Direct	Yes
0384A 03	Slabs	C.S.	1958 [1966]	8328	1919	1919	1919	PSP	SS, SL	OT	Direct	Yes
0396D	Slab	C.S.	1959	2031	IR	IR	IR	PSP,SS		RUP(UNK) RET(UNK)	Indirect To POTW	No
0396E	Finished Strip	C.S.	1941	1419	4465	4465	2103	PSP	SL	RTP-52.9 RET-38 BD-9.1	Direct	No
0424	Slab, Blooms	SS	1971	450	800	800	160	-	FDS SL,CT PSP,SS,SSP	RTP-80 BD-20	Direct	No
0430C 01	Plate Mill	SS	1962	90	288	288	288	-	SCR,BIO NL,FLL,CL FLP,SS,CLA SL	OT	Direct	No
0430C 02	Sheet Bar Mill	C.S.	1920 [1958]	114	1655	1655	1655	-	SCR,BOA, NL,FLL,FLP, CL,SS,CLA, SL	OT	Direct	No
0432A	Blooms	C.S.	1909 [1953]	5724	IR	IR	IR	PSP	FLP,FLM, CL,SS,SCR, VF	OT	Direct	Yes
0432B	Blooms & Slabs	C.S.	1952	5703	IR	IR	IR	PSP,SS	-	OT	Direct	Yes
0432C	Slabs	C.S.	1957 [1967]	10,119	1965	1083	151	PSP,SS	VF,FLL,FLP, NW,CL, CT	RUP-44.9 BD-7.7 RTP-47.4	Direct	Yes

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0432J	Bloom Slab	SS	1950	1089	IR	IR	IR	PSP,SSP	-	OT	POTW	No
0440A	Slab, Bloom	SS	1967	387	27,163	0	0	PSP,SSP SS	-	RTP-100	Zero Discharge	No
0448A 01	Blooms & Slabs	C.S.	1944 [1954]	1938	IR	IR	IR	PSP,SSP, CL,SL, CT	-	RTP(UNK)	UNK	No
0448A 02	Slabs	C.S.	1858	6636	IR	IR	IR	PSP,SSP CL,SL CT	-	RTP(UNK)	UNK	Yes
0460A	Blooms	C.S.	1917 [1956]	1242	6145	5913	3853	PSP	SCR,SL SSP,SS	RTP-37.3 RET-62.7	Indirect	Yes
0476A	Blooms & Slabs	C.S.	1915 [1940]	1699	3273	382	382	PSP	FLP,NL,A SCR,CL, SL,SS	RTP-88.3 BD-11.7	Direct	No
0492A	Slab	C.S.	1953	3714	1551	1551	1551	PSP,SSP	SL,SS	RET(100)	Indirect	No
0496	Slabs & Blooms	C.S.	1959 [1968]	2415	3816	3816	477	PSP	SSP,SS,FLP, FDS	RUP-87.5 BD-12.5	Direct	Yes
0528A	Blooms & Slabs	C.S.	1949	5550	2128 (1038)	2128	2128	PSP	SSP,CO,ES, FLP,NL,SCR, CL,T,SS	OT	Direct	Yes
0584A 01	Blooms	C.S.	1930 [1958]	4605	1873	1873	1873	PSP	SSP,SS	OT	Direct	Yes
0584A 02	Slabs	C.S.	1953	9888	1456	1456	1456	PSP	SSP,SS	OT	Direct	Yes
0584C	Slabs	C.S.	1953	8718	344	344	344	PSP,SS	SS,SL, FDS,CLB	OT	Direct	No
0584F	Slabs & Blooms	C.S.	1920 [1962]	7041	532	511	511	PSP	SL SS	OT	Direct	Yes

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0612 01	Slabs & Blooms	C.S.	1952	3312	3913	3913	78	PSP	SSP, SL,CT, SCR,SS,FDS	RTP-98 RET-2	Indirect	No
0612 02	Slabs & Blooms	C.S.	1974	2631	4926	4926	98.5	PSP	SSP, SL,CT, SCR,SS,FDS	RTP-98 RET-2	Indirect	No
0640	Blooms	C.S.	1914 [1938]	1878	4332	1265	1265	PSP	FDS,SL	RUP-70.8 BD-29.2	Direct	No
0652A	Blooms	C.S.	1906 [1952]	795	1087	1087	1087	PSP	FLL,FLA, ML,MC, SSP,SS,CT	OT	Direct	No
0672B	Bloom	HSLA	1952	453	6517	1272	1272	PSP	-	RUP-80 BD-20	POTW	No
0684A	Slabs & Blooms	C.S.	1910 [1957]	4851	742	742	742	PSP,SS	-	OT	Direct	No
0684B	Blooms	C.S.	1917 [1973]	4905	734	734	734	PSP,SSP, SS	-	OT	Direct	No
0684D	Bloom	Alloy Steel	1915		NOT IN OPERATION			SL,SS	-	-	-	No
0684E	Slab, Bloom	Alloy Steel	1916 [1927]	2520	857	857	857	PSP,SSP, SS,FLC, CL,CT	-	OT	Direct	No
0684F 01	Slabs & Blooms	C.S.	1937	1752	6164 (2466)	6164	6114	PSP	SSP,SS, SCR,FLL,FLP FLC,FDS VF	BD-99.2 RTP-0.8	Direct	Yes
0684F 02	Slabs	C.S.	1956	7110	1985	1965	1965	PSP	SSP,SCR FLL,FLP,FLC, FDS,VF	RTP-0.8 BD-99.2	Direct	Yes
0684G	Slabs & Blooms	C.S.	1916 [1951]	2208	2400	2048	1839	PSP	SSP,SCR, FLL,FLP, FLC,CL, FDS,VF	RUP-14.7 BD-76.6 RET-8.7	Direct	Yes

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0684H	Blooms	C.S.	1943	5565	1811 (857)	1462	96	PSP	CL, FDS	RTP-94.7 BD-5.3	POTW	Yes
0684I	Slabs & Blooms	C.S.	1930	5517	679	679	360	PSP	SSP, SS,BOA, MW,SL	BD-52.9 RTP-47.1	Direct	No
0724A	Slabs & Blooms	C.S.	1957	4152	4162	867	867	PSP,FLP		RUP-79.2 BD-20.8	Direct	Yes
0784	Bar	C.S.	**	**	**	**	**	**	**	**	**	**
0796A	**	**	1926	**	**	**	**	**	**	**	**	
0856F	Slabs	C.S.	1952	12,612	1827	1370	1370	PSP	GF, FLP,BOA, SL,SS	RUP-25 BD-75	Direct	Yes
0856H 01	Slabs, Blooms, & Axles	C.S.	1926	1872	2725	2725	2725	PSP	SSP,SS	OT	Direct	No
0856H 02	Slabs, Blooms, & Rounds	C.S.	1926	1830	2787	2787	2787	PSP	SSP,SS	OT	Direct	No
0856H 03	Slabs	C.S.	1944	8916	727	727	727	PSP	-	OT	Direct	Yes
0856N	Slabs & Blooms	C.S.	1949	7905	3734	1967	1967	PSP	SS, SL	RUP-47 BD-53	Direct	Yes
0856Q 01	Blooms	C.S.	1908 [1955]	3195	IR	IR	IR	PSP	SL SS	OT	Direct	No
0856Q 02	Blooms	C.S.	1907	1968	IR	IR	IR	PSP	SL SS	OT	Direct	No
0856R	Slabs & Blooms	C.S.	1959	5391	2782	2782	2782	PSP,SS,	-	OT	Direct	Yes
0856T 01	Slabs & Blooms	C.S.	1894 [1907]	4059	1281	1281	1281	PSP,SSP,SS	-	OT	Direct	No

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton Applied	Flows in Gallons/Ton Process	Flows in Gallons/Ton Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode	Machine Scarfing
0856T 02	Slabs	C.S.	1909	2895	298	298	298	Scale Bucket	-	OT	Direct	No
0860B 01	Slabs, Blooms	C.S.	1909	2406	1915	1903	1903	PSP,SSP	SL, SS	REU-0.6 BD-99.3	Direct	Yes
0860B 02	Slabs & Billets	C.S.	1909	3492	3464	3439	3439	PSP	SL, SS	REU-0.7 BD-99.3	Direct	Yes
0860B 03	Slabs, Blooms & Wheels	C.S.	1918 [1953]	1260		NOT IN OPERATION						
0860B 04	Slabs & Blooms	C.S.	1931	2529	3587	3587	3587	PSP	SL SS	OT	Direct	No
0860B 05	Slabs	C.S.	1958	11,178	1095	1092	1092	PSP	SL SS	REU-0.2 BD-99.8	Direct	Yes
0860H 01	Slabs & Blooms	C.S.	1931	2988	6747	6747	234	PSP	CL,CT VF,FLL, FLA,SCR, SSP,SS,T	RTP-96.6 BD-3.4	POTW	No
0860H 02	Slabs	C.S.	1931	8490	1866	1866	65	PSP	CL,CT,VF, FLL,FLA, SCR,SSP, SS,T	RTP-96.5 BD-3.5	POTW	No
0860H 03	Slabs, Blooms	C.S.	1959	3441	5859	5859	203	PSP,SS	CL,CT, VF,FLL, FLA,SCR, SSP,SS,T	RTP-96.5 BD-3.5	POTW	No
0864A 01	Slabs & Blooms	C.S.	1944 [1946]	6795	1272	318	318	PSP	-	RUP-75 REU-25	Indirect	No
0864A 02	Blooms	C.S.	1976	2373	2124	303	127	PSP	CL,SS, SL	RUP-85.7 RET-8.9 BD-5.4	Direct	No
0864C	Blooms	C.S.	1928	450	1280	1280	93	PSP,SS	SL, SS,CT, CLA,EB,FLP	RTP-92.7 BD-7.3	Direct	No

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity Tons/Day	Flows in Gallons/Ton			Treatment Components		Operating Mode	Discharge Mode	Machine Scarfing
					Applied	Process	Discharge	Process Treatment	Central Treatment			
0868A 01	Slabs & Blooms	C.S.	1902	3000	1236	1236	1236	PSP	SSP, SS,SL	OT	Direct	No
0868A 02	Slabs & Blooms	C.S.	1919	2340	614	614	599	PSP	SL, SSP,SS	RTP-2.4 RET-86.1 BD-11.5	Direct and Indirect	No
0868A 03	Slabs	C.S.	1939	4692	1886	965	917	PSP	SL, SSP,SS	RTP-2.6 RET-42.7 BD-5.9 RUP-48.8	Direct and Indirect	No
0920A	Slabs	C.S.	1928	5361	3465	3384	510	PSP,SSP F	-	RTP-87.6 BD-12.4	Direct	Yes
0920B	Slabs & Blooms	C.S.	1908 [1951]	5325	2382	760	760	-	PSP,SS	RUP-68 BD-32	Direct	No
0920N	Slabs	C.S.	1952	4545	4309	4309	507	PSP,SSP F	-	RTP-88.2 BD-11.8	Direct	Yes
0940	Rebar	C.S.	1967 [1973]	135	1067	1067	0	PSP	-	RUP-100	Zero Discharge	No
0946A	Blooms	C.S.	1925 [1937]	3066	1550	1409	1409	PSP	SSP,FDS, FLP,T	RUP-9 RET-91	Indirect	Yes
0948A	Slabs, Blooms,	C.S.	1931 [1951]	3909	3481 (2376)	1271	1271	PSP	-	RUP-63.5 BD-36.5	Direct	Yes
0948B	Slabs & Blooms	C.S.	1914 [1954]	3930	1905	1905	1905	PSP	-	OT	Direct	No
0948C 01	Slabs & Blooms	C.S.	1929	4461	710	710	710	PSP	SSP, SL,SS	OT	Direct	No
0948C 02	Slabs	C.S.	1953 [1968]	7923	3908 (600)	3908	3908	PSP	SSP, SL,SS	OT	Direct	Yes

TABLE III-2
GENERAL SUMMARY TABLE
HOT FORMING-PRIMARY
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KEY TO SYMBOLS & ABBREVIATIONS

Steel Type

AT : Alloy Tool
C.S. : Carbon Steel
Elect.: Electrical Steel
HSLA : High Strength, Low Alloy
SS : Stainless Steel
UNK : Data not provided by company

Operating Mode (Number following abbreviation indicates % of applied rate in each case)

BD : Blowdown
OT : Once-Through
RET: Reused on operations other than hot forming following treatment
REU: Reused on operations other than hot forming without treatment
RTP: Recycled to hot forming operations following treatment
RUP: Recycled to hot forming operations without treatment

Treatment Components

For a description of the treatment component codes, see Table VII-1.

Discharge Mode

Direct : Discharged from process to receiving stream.
Indirect : Reused in some other process, then eventually discharged to receiving stream.
POTW : Discharged from process to publicly owned treatment works.
Indirect to POTW: Reused in some other process, then eventually discharged to publicly owned treatment works.

Determination of Capacity Value

The capacity values for primary operations (and the other hot forming operations) were calculated by taking the average 1976 production per turn and multiplying by three.

* : Dry operation
** : Confidential Data
IR : Inadequate Response
( ) : Portion of applied flow attributable to machine scarfing
[ ] : Year of most recent major rebuild
N/A: Not applicable

TABLE III-3

HOT FORMING SECTION
SUMMARY TABLE

Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Flow (Gallons/Ton) Process	Flow (Gallons/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0060C 01	98° Gothic	CS60, LA40	1913	1320	UNK	UNK	UNK	PSP	CNT(UNK) (UNK),SSP SS, FLP	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060C 02	Rounds	CS60, LA40	1913	1017	UNK	UNK	UNK	PSP	CNT(UNK) (UNK)SSP, SS, FLP	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060C 03	Rounds	CS45, LA55	1913	462	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SS, FLP	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060F 01	I-Beams,Angles Rounds,Flatbeds Grader Blades	CS40, LA10 AS850	1942	903	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SS,SCR SL(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060F 02	I-Beams,Channel Angle, Round, Flat Bar,Rebar Spigot Section Grader Blade	CS70, LA10 AS820	1942	816	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SCR,SS SL(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060F 03	Round	CS45, LA15 AS840	1944	2070	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SCR,SS,SL (UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060F 04	Round, Square Bloom	CS55, LA15 ATS30	1950	2070	UNK	UNK	UNK	PSP	CNT(2), (UNK)SSP, SCR,SS, SL(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0060F 05	WF-Beams	CS80, LA20	1971	1224	[11576]	[4988]	[59]	PSP,SSP SS FDSP CL,VF	CNT(4)(65) SL(UNK)	RUP(56.5) RTP(43) BD(0.5)	Direct
0060G 01	**	**	**	**	**	**	**	PSP SSP	CNT(2)(26.6) SCR,SS, SL(UNK)	RUP(6.3) REU(50.6) BD(43.1)	Direct
0060G 02	**	**	**	**	**	**	**	PSP SS	CNT(2)(9.8) SCR,SS,SL (UNK)		OT Direct
0060G 03	**	**	**	**	**	**	**	PSP, SSP SS	CNT(2)(8.8) SCR,SS, SL(UNK)	REUT(16) BD(84)	Direct
0060G 04	**	**	**	**	**	**	**	PSP SS	CNT(2)(24.6) SCR,SS SL(UNK)		OT Direct

TABLE III-3
HOT FORMING SECTION
SUMMARY TABLE
PAGE 2

Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0060H 01	Rounds, Rebar Studded Tee	CS100	1929	1071	3025	2057	121	PSP,SS	CNT(1)(6.3) SS,SCR, SL(UNK)	RUP32,RTP64 BD4	Direct
0060I 01	Rounds,Squares Flat Bars	SS100	1956	176	10,636	10,256	0	PSP,SS	CNT(UNK) (25)SSP, SS,CT	RTP(25) RUP(75)	Zero Discharge
0060I 02	Rounds	SS100	1946	138	13,040	13,043	0	PSP,SS	CNT(UNK) (25)SSP, SS,CT	RTP(100)	Zero Discharge
0060K 01	Angle,Rounds, Flat Bars,Rebar Fence-Sign Post	CS100	1920	537	8,045	8,045	34.9	PSP	CNT(UNK) (UNK)SSP, SS,CT	RTP(99.6) BD(0.4)	Direct
0068 01	Dbl Bevel,Strip & Bands Cotton Ties	CS100	1901	78	UNK	UNK	UNK			OT	POTW
0068 02	Rounds,Squares Flat Bar,Strip	CS100	1905	270	UNK	UNK	UNK	PSP,SS		OT	POTW
0068 03	Channel,Angle Square,Flat Bar Rebar	CS100	1914	144	UNK	UNK	UNK	PSP		OT	POTW
0068 04	Channel,Angle Squares,Flat Bar Rebar	CS100	1956	570	UNK	UNK	UNK	PSP		RUP-(UNK) BD(UNK)	POTW
0068 05	Rods	CS100	1968	399	UNK	UNK	UNK	PSP,SS		RUP(UNK) BD(UNK)	POTW
0068B	Angle,Channel Round,Square Flat, Rebar	CS100	1976	[353](1)	[20,386]	[20,386]	[0]	PSP		RUP(100)	Zero Discharge
0088A	H-Posts,Rounds	CS31, LA49,SS9 CMHR11	1942	531	561	561	561	PSP		OT	Direct
0088D	Rounds	CS33, LA56 OS11	1962	885	9,836	9,836	73.2	PSP,SSP	CNT(2)39 HL,FLP, CL,SS,VF	RTP(99.2) BD(0.8)	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0112 01	I-Beams, WF-Beams	CS79, LA21	1907	2709	UNK	UNK	UNK	PSP		OT	Direct
0112 02	I-Beams, WF-Beams	CS89 LA11	1917	1086	UNK	UNK	UNK	PSP		OT	Direct
0112 03	Billets	CS85 LA15	1955	3771	UNK	UNK	UNK	PSP		OT	Direct
0112 04	Rounds	ATS100	1915	195	UNK	UNK	UNK	PSP		OT	Direct
0112 05	Billets	CS5, LA80 ATS15	1916	861	UNK	UNK	UNK	PSP		OT	Direct
0112 06	I-Beam, Channel Zee, Angle	CS86, LA14	1917	552	UNK	UNK	UNK	PSP		OT	Direct
0112 07	Rounds, Squares Hexagon, Flat Bar Octagon	SS2, ATS98	1963	138	33,391	33,391	3673	PSP, SS		RTP(89) BD(11)	Direct
0112 08	Angle	CS87, LA13	1919	642	UNK	UNK	UNK	PSP		OT	Direct
0112 09	Rounds, Squares Hexagon, Flat Bar Octagon	ATS100	1917	17.4	UNK	UNK	UNK	PSP		OT	Direct
0112 10	WF-Beams, I-Beams Channel, Bulb Angle, Ship Channel	CS85 LA15	1968	2301	UNK	UNK	UNK	PSP, SS		OT	Direct
0112A 01	Billets	CS100	1918	3735	4627	4627	771	PSP		RTP(83.3) BD(16.7)	Direct
0112A 02	Rebar	CS100	1937	1101	UNK	UNK	3662	PSP		RUP(UNK) BD(UNK)	Direct
0112A 03	Rounds, Rod	CS100	1968	1455	UNK	UNK	3959	PSP, SS		RUP(UNK) BD(UNK)	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Process	Discharge	Treatment Components Process Treatment	Central Treatment	Operating Mode	Discharge Mode
0112B 01	WF-Beams	CS100	1926	3321	UNK	UNK	UNK	PSP	CHT(1) (UNK)T, FDS(UNK)	RET(UNK) BD(UNK)	Direct
0112B 02	I-Beam,Channel, Zee,Sheet Piling Angle,Buldozer Track Shoe	CS85 LA15	1926	1461	UNK	UNK	UNK	PSP	CHT(1) (UNK),T, FDS(UNK)	RET(UNK) BD(UNK)	Direct
0112B 03	Billets, Rail Round	CS80 LA20	1928	1563	UNK	UNK	UNK	PSP	CHT(1) (UNK),T, FDS,(UNK)	RET(UNK) BD(UNK)	Direct
0112B 04	Billets	CS80 LA20	1930	2538	UNK	UNK	UNK	PSP	CHT(1) (UNK),T, FDS(UNK)	RET(UNK) BD(UNK)	Direct
0112B 05	Rounds, Flat Bar,Hinge Bar, Leaf Spring	CS76 LA24	1940	711	UNK	UNK	UNK	PSP	CHT(1) (UNK),T, FDS(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0112B 06	Round, Flat Bar Rebar	CS74 LA26	1946	900	UNK	UNK	UNK	PSP	CHT(1) (UNK),T, FDS(UNK)	RTP(UNK) RET(UNK)	Direct
0112B 07	Round, Flat Bar	CS76 LA24	1976	444	UNK	UNK	UNK	PSP	CHT(1) (UNK),T, FDS(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0112C 01	Wheel Blanks	CS87 AS13	1920	180	UNK	UNK	UNK	PSP	CHT(UNK) SSP,SS,T, FDS(UNK)	OT	Direct
0112C 02	RR. Wheels	CS99 AS1	1920	375	UNK	UNK	UNK	PSP	CHT(UNK), SSP,SS,T, FDS(UNK)	OT	Direct
0112C 03	Billets, Round Slab	CS92 AS8	1940	1728	UNK	UNK	UNK	PSP	CHT(2) (UNK)SSP,SS T,CT,A,NC, FDS(UNK)	OT	Direct
0112C 04	Rounds	CS92 AS8	1950	849	UNK	UNK	UNK	PSP	CHT(UNK) SSP,SS,T, FDS(UNK)	OT	Direct
0112C 05	Billets	CS87 AS13	1952	3234	UNK	UNK	UNK	PSP	CHT(2) (UNK),SSP,SS T,CT,A,NC,FDS (UNK)	OT	Direct
0112C 06	Round Corner Squares,Tie Clips Bearing Segments	CS95 AS5	1918	105	UNK	UNK	UNK	PSP	CHT(2) (UNK),SSP,SS, T,CT,A,NC,FDS (UNK)	OT	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0112C 07	Bulb Angle, Rail Round,Square,Flat Bar,Tee Bar,Mine Ties,Rim Section Brake Beam	CS89 AS11	1926	648	UNK	UNK	UNK	PSP	CNT(2) (UNK),SSP SS,T,A, NC, FDS(UNK)	OT	Direct
0112C 08	Round, Square Hexagon, Flat Bar	CS88 AS12	1926	849	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SS,T,A,NC FDS(UNK)	OT	Direct
0112C 09	Flat Bar,Auto Leaf Sprg Band Tie Clip,Rail Anchor	CS91 AS9	1926	204	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP,SS, T,A,NC,FDS (UNK)	OT	Direct
0112C 10	Round, Square, Hexagon,Special Shapes	CS81 AS19	1963	999	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SS,T,A,NC, FDS(UNK)	OT	Direct
0112E 01	Billets, Rail	CS100	1914	3705	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP,SS, O3,SL(UNK)	OT	Direct
0112E 02	Billets, Rounds Flat Bar,Misc.	CS97.2 LA1.4 BS1.4	1918	1200	UNK	UNK	UNK	PSP	CNT(2) (UNK)SS, O3,SL(UNK)	RUP(UNK) BD(UNK)	Direct
0112E 03	Rebar	CS100	1960	2259	UNK	UNK	UNK	PSP	CNT(2) (UNK)SS, SL(UNK)	RUP(UNK) BD(UNK)	Direct
0112F 01	I-Beam,Channel Angles,Rounds Square,Flat Bar	CS79 LA21	1922	567	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SS,CL,CT	RTP(UNK) REP(UNK) BD(UNK)	Direct
0112F 02	Round, Square Hexagon, Flat Bar, Rebar	CS97 LA3	1948	669	UNK	UNK	UNK	PSP	CNT(2) (UNK)SSP, SS,CL,CT	RTP(UNK) REP(UNK) BD(UNK)	Direct
0112G 01	I-Beam, Channel Zee,Angle,Round Flat Bar	N/A	1914	417	UNK	UNK	UNK	PSP SS	CNT(2) (UNK)SSP SS	RTP(UNK) REP(UNK) BD(UNK)	Direct
0112G 02	I-Beam,Channel, Angle, Round, Square,Flat Bar,Rebar	N/A	1958	675	UNK	UNK	UNK	PSP SS	CNT(2) (UNK)SSP SS	RTP(UNK) REP(UNK) BD(UNK)	Direct
0112I	Rounds,Squares Flat Bars	CS92 LA8	1926	711	UNK	UNK	UNK	PSP,SS, P,SS,E, CT,FDS (UNK)		RUP(UNK) BD(UNK)	Direct
0112J 01	I-Beam,Channel Angle,Square, Flat Bars,Billet	CS95 LA5	1924	378	UNK	UNK	UNK	PSP	CNT(1) (UNK)SSP,SS CT,SL(UNK)	RTP(UNK) REP(UNK) BD(UNK)	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Flow (Gallons/Ton) Process	Flow (Gallons/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0112J 02	I-Beam, Channel, Angle, Flat Bar Jail Bar	CS100	1924	339	UNK	UNK	UNK	PSP	CNT(1) (UNK)SSP,SS, CT,SL(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0112J 03	Channel, Angle Hot Strip	CS100	1915	177	UNK	UNK	UNK	PSP	CNT(1) (UNK)SSP,SS CT,SL(UNK)	RTP(UNK) RET(UNK) BD(UNK)	Direct
0136B 01	Channel, Angle Round, Square, Flat Bar, Rebar	CS96 LA4	1908	522 (Closed 11/77)	8372	8372	100	PSP	SSP	RTP(98.8) BD(1.2)	POTW
0136B 02	Channel, Angle Round, Square, Flat Bar, Rebar	CS96 LA4	1967	354	[22,942]	[22,942]	[121]	PSP SSP		RTP(99.5) BD(0.5)	POTW
0136C	Rebar, Flat Bar	CS100	1913	411	11,859	11,859	581	PSP,SSP SS,CT,02		RTP(95.1) BD(4.9)	POTW
0176 01	Round, Square, Hex, Flat Bar, Octagon Flutes	N/A All Special	1918	30.2	6190	6190	223	PSP	CNT(2)(14) SSP,SS,T,CT	RTP(96.4) BD(3.6)	Direct
0176 02	Rounds, Square, Hex, Flat Bar, Octagon	N/A All Special	1927	10.5	34,285	34,285	1234	PSP	CNT(2)(26) SSP,SS,T,CT	RTP(96.4) BD(3.6)	Direct
0176 03	Round, Square, Hex Flat Bar, Flutes	N/A All Special	1928	78	4911	4911	172	PSP	CNT(2)(28) SSP,SS,T,CT	RTP(96.5) BD(3.5)	Direct
0176 04	Wire	N/A All Special	1953	168	[13,700]	[13,700]	[336]	PSP	CNT(2)(18) SSP,SS,CL, CY,T	RTP(94.0) BD(6.0)	Direct
0188B	Round, Rebar	CS100	1940	804	7258	3657	145	PSP,SSP CT,SS		RTP(98) BD(2)	Direct
0188C	Round, Rebar	CS100	1956	462	7480	7480	140	PSP,SSP SS,SL(UNK)		RTP(98.1) BD(1.9)	Direct
0196A 01	**	**	**	**	**	**	**	**	**	**	**
0196A 02	**	**	**	**	**	**	**	**	**	**	**
0196A 03	**	**	**	**	**	**	**	**	**	**	**

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Process	Discharge	Treatment Components Process Treatment	Central Treatment	Operating Mode	Discharge Mode
0196A 04	**	**	**	**	**	**	**	**	**	**	**
0196A 05	**	**	**	**	**	**	**	**	**	**	**
0196A 06	**	**	**	**	**	**	**	**	**	**	**
0196A 07	**	**	**	**	**	**	**	**	**	**	**
0196A 08	**	**	**	**	**	**	**	**	**	**	**
0916A 09	**	**	**	**	**	**	**	**	**	**	**
0196A 10	**	**	**	**	**	**	**	**	**	**	**
0196A 11	**	**	**	**	**	**	**	**	**	**	**
0240A 01	Round,Square	CS25 LA75	1943	948	UNK	UNK	UNK	PSP SSP	CNT(1) (UNK)SS,SL (UNK)	OT	Direct
0240A 02	Round,Square Hex,Flat Bar	CS25 LA75	1941	474	UNK	UNK	UNK	PSP SSP	CNT(1) (UNK)SS,SL (UNK)	OT	Direct
0256K	Wire	**	1936	**	**	**	**	PSP,NL, FLP,CL		OT	Direct
0256N 01	Billets,Round	**	1950	**	**	**	**	PSP		RUP(100)	Zero Discharge
0256N 02	Billets,Round Square,Flat Bar	**	1920	**	**	**	**	PSP		RUP(100)	Zero Discharge
0256N 03	Billets,Round Square,Hex,Flat Bar	**	1920	**	**	**	**	PSP		RUP(100)	Zero Discharge

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Flow (Gallons/Ton) Process	Flow (Gallons/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0288A 01	Rings	CS20 ATS5 OS75	1925	7.2	4114	4114	4114	PSP, SSP,SS		OT	Direct
0288A 02	Rings	CS30 ATS5, OS65	1939	13.8	2527	2527	2527	PSP, SSP,SS		OT	Direct
0288A 03	Rings	CS30 SS2,OS68	1937	22.2	2359	2359	2359	PSP, SSP,SS		OT	Direct
0288A 04	Rings	CS20 SS1,ATS1, OS78	1941	11.19	3136	3136	3136	PSP, SSP,SS		OT	Direct
0288A 05	Rings	CS56 SS2,ATS2, OS40	1967	20.5	1995	1995	1995	PSP SS		OT	Direct
0288A 06	Rings	CS50 OS50	1960	4.0	7014	7014	7014	PSP SSP,SS		OT	Direct
0288A 07	Rolled R.R.Wheels	CS100	1919	333.6	316	316	316	PSP, SSP,SS		OT	Direct
0288A 08	Rings	CS95 OS5	1919	36.6	1328	1328	1328	PSP, SSP		OT	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Flow (Gallons/Ton) Process	Flow (Gallons/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0316	Round, Rebar	CS100	1959	446	9044	9044	5698	PSP	CNT(3)(36) SS,CT,SL (UNK)F(04)	RTP(37) BD(63)	Indirect
0316A	Billets,Rebar	CS100	1970	420	7543	7543	0	PSP, SSP,SS		RUP(100)	Zero Discharge
0316B	Round, Rebar	CS100	1961	423	10,383	10,383	0	PSP, SSP,SL (UNK)		RTP(100)	Zero Discharge
0316C	Round, Rebar	CS100	1976	Started 9/76	UNK	UNK	UNK	PSP		UNK	UNK
0320 01	Billets	ABS100	1936	1500	UNK	UNK	UNK	PSP	CNT(2) (UNK)SCR,NC SS,CL,SL(UNK)	OT	Direct
0320 02	Billets	ABS100	1936	1428	UNK	UNK	UNK	PSP	CNT(2) (UNK)SCR,NC, SS,CL,SL(UNK)	OT	Direct
0320 03	Flat Bars	ABS100	1936	588	UNK	UNK	UNK	PSP	CNT(2) (UNK)SCR,NC SS,CL,SL(UNK)	OT	Direct
0384A 01	Billets	CS30 LA1 FMS69	1967	2418	3055	3055	3055	PSP SSP	CNT(1)(14) SS,SL(UNK)	OT	Direct
0384A 02	Billets, WF Blanks	CS55, LA3, FMS42	1967	3420	3055	3055	3055	PSP, SSP	CNT(1)(14) SS,SL(UNK)	OT	Direct
0384A 03	Billets, WF, I-Beam,Channel,Zee Angle,Geuser Shoe, Brg.Caps	CS77, LA19	1917	1479	3797	3797	3797	PSP	CNT(1)(3.8) SSP,SL(UNK)	OT	Direct
0384A 04	Billets,I-Beam Channel,Angle, Bulb Angle,Misc	CS56 LA21 FMS23	1902	933	3860	3860	3860	PSP	CNT(1)(29) SS,SL(UNK)	OT	Direct
0384A 05	Billets,I-Beams Channel,Zee,Bulb Angle,Angle,Round Square,Hex,Flat Bar, Misc	CS65 LA15, Tee5, RAL15	1925	816	8029	8029	8029	PSP	CNT(2)(3) SS,SL(UNK)	OT	Direct
0384A 06	Billets,Rounds Square,Angle,Hex Flat Bar,Rebar, Misc.	CS98 LA2,	1969	1758	3376	3355	79	PSP, SSP	CNT(2) (UNK)CL,CT, FLL,FLA,FLP FLM	RUP(33) RTP(64.6) BD(2.4)	Direct
0384A 07	Angles,Round, Square,hex,Flat Bar,Rebar,Misc	CS65, LA15 Tee15, RAL25	1931	879	3276	3276	3276	PSP	CNT(2)(2.5) SS,SL(UNK)	OT	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0396D	Billets	CS100	1959	2031	0	0	0				NA
0424 01	Billets,Angle Round,Square,Hex Flat Bar	SS80 ATS20	1942	44	7283	7283	6024	PSP	CNT(1)(16), SS,SSP,CT, SL(UNK)FDS (UNK)	RTP(17) BD(83)	Direct
0424 02	Angle, Round, Square,Hex,Flat Bar	SS80 ATS20	1946	25	11,707	11,707	10654	PSP	CNT(1)(9) SS,SSP,CT, SL(UNK)FDS (UNK)	RTP(9) BD(91)	Direct
0424 03	Angle,Round, Square,Hex,Flat Bar	SS80 ATS20	1920	25	10,537	10,537	9588	PSP	CNT(1)(8), SS,SSP,CT, SL(UNK)FDS (UNK)	RTP(9) BD(91)	Direct
0432A 01	Bar, Billet Other Shapes	CS80 LA20	1910	2709	UNK	UNK	UNK	PSP		OT	Direct
0432A 02	WF,I-Beam,Channel Angle,Flat Bar Jr.Channel,Truck Rims	CS60 LA40	1925	1167	[6340]	[6340]	[6340]	PSP	CNT(2) (UNK)SCR,CL FLL,VF,SS, FLM	OT	Direct
0432A 03	Rounds	CS70 LA30	1927	1303	UNK	UNK	UNK	PSP		OT	Direct
0432A 04	Rod	CS100	1952	1754	UNK	UNK	UNK	PSP SSP, CY,07		OT	Direct
0432B 01	Billets,Rounds, Square,Hex,Rebar	CS95 LA5	1931	1179	UNK	UNK	UNK	PSP SS		OT	Direct
0432B 02	Round,Square,Hex Flat Bar,Rebar, Octagon	CS95 LA4.5 S80.5	1953	1000	UNK	UNK	UNK	PSP SS		OT	Direct
0432J	Billets	OS10, SS90	1950	NA	UNK	UNK	UNK	PSP		OT	POTW
0440A	Angle,Round,Hex Square,Flat Bar Rebar	SS100	1928	45	3200	3200	3200	PSP	CNT(3)(18) SSP		POTW
0448A 01	Billets,WF,I-Beam,Channel,H-Section,Angle, Plate,Mine Arch	CS99 LA1	1944	1068	UNK	UNK	UNK	PSP	CNT(2) (UNK)CL,CT, SL(UNK)	RUP(UNK) RTP(UNK) RET(UNK) BD(UNK)	Direct
0448A 02	Channel,Round Rebar, Misc.	CS98 AS2	1943	583	UNK	UNK	UNK	PSP SSP	CNT(2) (UNK)CL,CT, SL(UNK)	RUP(UNK) RTP(UNK) RET(UNK) BD(UNK)	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0460A 01	Wire	CS100	1920	897	4816	4415	0	PSP SSP	CNT(2)(19) SCR,SS,T, SL(UNK)	RTP(100)	Zero Discharge
0460A 02	Wire	CS100	1958	702	7744	7385	0	PSP SS	CNT(2)(25) T,SCR, SL(UNK)	RTP(100)	Zero Discharge
0460B	Channel,Angle, Square,Round,Tee, Flat Bar	CS100	1969	441	32,686	327	327	PSP SSP, SS		RUP(99) BD(1)	POTW
0468B	Fence Post,Flanged Channel,Wire,Rebar	CS100	1968	1294	7,811	7,789	89	PSP,CT SSP,FLP, FF(UNK)		RTP(98.9) BD(1.1)	Direct
0468F	Wire, Rod, Rebar	CS100	1976	312	29,465	29,465	9841	PSP, SSP, SS	CNT(3)(69.5) SS,CT,SL (UNK)	RTP(66.6) BD(33.4)	Direct
0476A 01	Angle,Round,Square Flat Bar, Rebar	CS90 LA10	1915	190	16,719	16,293	10,786	PSP	CNT(2)(37), SCR,FLP,NL, CL,SS,CY, SL(UNK)	RTP(33.8) BD(66.2)	Direct
0476A 02	Rounds, Rebar	CS100	1946	502	9018	8746	1010	PSP, SS	CNT(2) (UNK)SCR,SS FLP,NL,CL, CY,SL(UNK)	RTP(88.8) BD(11.2)	Direct
0476A 03	Round,Square, Flat Bar,Rebar	CS75 LA25	1969	800	10,075	282	282	PSP, SS	CNT(2)(0.4) SCR,FLP,NL, CL,SS,CY, SL(UNK)	RUP(97.2) BD(2.8)	Direct
0584F	WF,I-Beam,Zee, Channel,Piling, Flat Bar,Angle	CS50 VGS50	1930	807	14,900	14,900	14,900	PSP	CNT(2)(5.5) SS,01,SL (UNK)	OT	Direct
0612 01	Billets	CS100	1952	3162	[4204]	[4204]	[84]	PSP SSP	CNT(1)(24.5) SCR,SR,FDS	RTP(98) BD(2)	Direct
0612 02	WF-Beam,Channel	CS100	1963	1386	[9870]	[9870]	[197]	PSP SSP	CNT(1)(19.4) SS,02,FDS	RTP(98) BD(2)	Direct
0612 03	WF-Beam,Channel Angle	CS100	1957	1092	[12,527]	[12,527]	[250]	PSP SSP,	CNT(1)(19.4) SS,02,FDS	RTP(98) BD(2)	Direct
0612 04	Angle,Round, Flat Bar,Rebar	CS100	1951	948	[4204]	[4204]	[84]	PSP SSP	CNT(1)(24.5) SS,02,FDS	RTP(98) BD(2)	Direct
0612 05	Round	CS100	1936	1239	5462	5462	174	PSP,SSP SS,CT, FDS(UNK)		RTP(96.8) BD(3.2)	Direct

TABLE III-3
HOT FORMING SECTION
SUMMARY TABLE
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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Flow (Gallons/Ton) Process	Flow (Gallons/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0640	Rod Mill,Round Rebar	CS100	1953	903	3352	3352	3352	PSP	CNT(2)(40) SL(UNK)FDS (UNK)	OT	Direct
0640A 01	Round,Rebar	CS100	1954	203	11,449	11,449	345	PSP SSP SS	CNT(2)(14), SS,SL(UNK) FDS(UNK)	RTP(97) BD(3)	POTW
0640A 02	Channel,Angle Round,Flat Bar	CS100	1954	507	13,775	13,775	331	PSP, SSP,SS	CNT(2)(44)	RTP(97.6) BD(2.4)	POTW
0652A 01	22"Structural, I-Beam,Channel	CS86 LA14	1906	243	7111	7111	7111	PSP, SS,SSP		OT	Direct
0652A 02	I-Beam,Channel Angle	CS86 LA14	1907	345	6261	6261	6261	PSP, SS,SSP		OT	Direct
0672A 01	I-Beam,Channel Angle,Flat Bar Rebar,Mini-Beams	CS84 LA16	1951	817	5418	5418	563	PSP,SS SSP,SS	CNT(2)(45) SS,T,SL(UNK)	RTP(89.6) BD(10.4)	Direct
0672A 02	Round,Flat Bar Jail Bar,Guy	CS100	1930	328	10,967	10,967	1151	PSP,SS SSP,SS	CNT(2)(37) SS,T,SL(UNK)	RTP(89.5) BD(10.5)	Direct
0672B 01	I-Beam,Channel Rail,Spec.Section	CS40 LA60	1907	270	4880	4747	0	PSP SSP		RTP(100)	Zero Discharge
0672B 02	I-Beam,Channel Bulb Angle,Spec. Bar	CS40 LA60	1918	462	5922	5610	0	PSP		RTP(100)	Zero Discharge
0684A 01	Billets	CS95 LA5	1911	2112	1705	1705	1705	PSP, SS		OT	Direct
0684A 02	Automotive Parts Scraper Blades	CS100	1911	573	10,052	10,052	10,052	PSP		OT	Direct
0684A 03	Billets	CS100	1923	2052		DISMANTLED					
0684D 01	Billets	CS15 AS85	1918	1929	1493	1493	1493	PSP	CNT(2)(33) SS,SL(UNK)	OT	Direct
0684D 02	Billets,Round Flat Bar	CS15 SS2,AS83	1920	1626	1689	1689	1689	PSP	CNT(2) (UNK)SS,SL (UNK)	OT	Direct
0684D 03	Round,Square,Hex Flat Bar,Octagon	SS48 AS52	1920	51	UNK	UNK	UNK	PSP	CNT(2) (UNK)SS,SL (UNK)	OT	Direct

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HOT FORMING SECTION
SUMMARY TABLE
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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Flow (Gallons/Ton) Process	Flow (Gallons/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0684E 01	Round,Square	CS22 SS1,AS77	1920	1185	3087	3087	1440	PSP	CNT(2)(45) SS,CL,CT,FL (UNK)SL(UNK)	RTP(53.3) BD(46.7)	Direct
0684E 02	Round,Square Hex,Octagon	CS19 SS6 AS75	1961	504	8571	8571	4003	PSP, SS	CNT(2)(53), SS,CL,CT,FL (UNK)SL(UNK)	RTP(53.3) BD(46.7)	Direct
0684F 01	Billets	CS98 LA2	1916	1338	3767	3767	3767	PSP, SS SSP	CNT(1)(14) SS,VF,FLL,FLP FLO6,SCR,CL FDS(UNK)	OT	Direct
0684F 02	Round,Square Flat Bar	CS92 LA8	1927	765	8282	UNK	UNK	PSP SS SSP	CNT(1)(17) SS,VF,FLL,FLP FLO6,SCR,CL, FDS(UNK)	OT	Direct
0684F 03	Round,Square Flat Bar,Rebar	CS98 LA2	1927	756	8190	UNK	UNK	PSP SS, SSP, SS	CNT(2)(8) CL,VF,SCR,FLL, FLP,FLO6,FDS (UNK)	OT	Direct
0684G 01	Billets	CS63 AT537	1916	900	2240	2240	2043	PSP	CNT(2)(15) NW,FLL,NL, FLO6,VF,CL FLP,SS	REU(8.8) BD(91.2)	Direct
0684G 02	Round,Square Flat Bar	CS81 AT519	1918	1131	4774	4774	4774	PSP SS	CNT(1)(51) SSP,SS	OT	Direct
0684G 03	Square,Flat Bar Rebar, Other	CS53 AT547	1918	573	5026	5026	5026	PSP,	CNT(1)(27.2) SSP,SS	OT	Direct
0684G 04	Round,Square Flat Bar,Rebar	CS61 AT539	1920	237	9722	9722	9722	PSP	CNT(1)(21.8)	OT	Direct
0684H 01	Billets	CS70 AS30	1943	2898	[4710]	[4710]	[14]	PSP SSP, SS	CNT(1)(15) FLP,SS,FLL, CL,T,CT	RTP(99.7)	POTW
0684H 02	Round, Square	CS33 AS67	1958	1758	[580]	[580]	[7]	PSP SSP SS	CNT(1)(15) FLP,SS,FLL CL,CT,T	RTP(99.7)	POTW
0684H 03	Round, Square Flat Bar	CS63 AS37	1943	2898	[930]	[930]	[3]	PSP SS	CNT(1)(7) FDS(UNK)CL	RTP(99.7)	POTW
0684H 04	Squares	CS85 AS15	1947	1314	3792	3792	193	PSP SSP	CNT(1)(13) VF,FLL,FLP, CL,T,SS,CT, FDS(UNK)	RTP(94.9) BD(5.1)	Direct

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SUMMARY TABLE
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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0684H 05	Rounds,Square, Hex,Flat Bar	CS68 LA2,AS30	1967	1707	[4800]	[2784]	[10]	PSP SS	CNT(UNK) (UNK),NA, FLP,CL,CT	RUP44 RTP55.7 BD0.3	POTW
0684H 06	Round,Hex,Rebar	CS82 ATS1,AS17	1958	996	3933	3933	[10]	PSP SS	CNT(1)(39)	RTP99.7	POTW
0684H 07	Round,Hex,Rebar	CS87 AS13	UNK	432	9067	9067	[10]	PSP SS	CNT(1)(39)	RPT99.7	POTW
0776G 01	Billets,Round Square	CS2,SS11 LA9,HS5 ATS73,	Pre-1950	66	*	*	*				
0776G 02	Round,Square Hex,Flat Bar	CS2,SS11 LA9,HS5 ATS73	Pre-1950	17	*	*	*				
0776G 03	Square,Hex, Flat Bars	CS2,SS11 LA9,HS5 ATS73	Pre-1950	6	*	*	*				
0776G 04	Combination Mill, Rounds	CS2,SS11 LA9,HS5 ATS73	Pre-1950	25	*	*	*				
0776H 01	Flat Bars	ATS100	1902	37	2347	2347	2347	PSP			Direct
0796A 01	**	**	**	**	**	**	**	**	**	**	**
0796A 02	**	**	**	**	**	**	**	**	**	**	**
0796A 03	**	**	**	**	**	**	**	**	**	**	**
0796A 04	**	**	**	**	**	**	**	**	**	**	**
0804B 01	Seamless Rings	CS75 HSLA25	1890	150	138	138	12.8		CNT(1)(19.6)	RTP(90.7) BD(9.3)	Direct
0804B 02	Seamless Rings	CS60 HSLA40	1948	342	131	131	131	PSP		OT	Direct
0856A 01	Flat Bar,Specials	CS79 LA14,AS7	1903	471	UNK	UNK	UNK	PSP SS		OT	Direct
0856A 02	Channel, Zee, Bulb Angle,Angle	CS67 LA31,AS1.8	1905	525	UNK	UNK	UNK	PSP SS		OT	Direct

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SUMMARY TABLE
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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0856A 03	I-Beam,Channel Angle	CS89 LA11,AT80.2	1907	396	UNK	UNK	UNK	PSP		OT	Direct
0856A 04	I-Beam,Channel H-Beam,Tee,Misc	CS96, LA3.5 AS0.3	1910	444	UNK	UNK	UNK	PSP		OT	Direct
0856F 01	Blooms & Skelp	CS100	1952	6867	1258	1258	419	PSP SS	CNT(2)(3), BOA1,FLP, GF,SL(UNK)	RUP(66.7) BD(33.3)	Direct
0856F 02	Billets,Round Skelp	CS100	1952	6867	952	952	476	PSP SS	CNT(2)(3), BOA1,FLP GF,SL(UNK)	RUP(50) BD(50)	Direct
0856F 03	Billets	CS100	1952	5232	UNK	UNK	UNK	PSP SS	CNT(2)(6), BOA1,FLP, GF,SL(UNK)	RUP(50) BD(50)	Direct
0856F 04	Angle,Round Flat Bar,Rebar	CS100	1953	1057	12,238	12,238	6804	PSP SS	CNT(2)(8) BOA1,FLP, GF,SL(UNK)	RUP(44.4) BD(55.6)	Direct
0856F 05	Rod	CS100	1969	2133	8101	8101	8101	PSP	CNT(2)(97) SS,SL(UNK)	OT	Direct
0856H 01	WF-Beam,H-Pile	CS86, LA14	1927	1683	1515	1515	1515	PSP SS	CNT(2)(25)	OT	Direct
0856H 02	I-Beam,Channel Zee,Sheet Piling Misc. Shapes	CS72, LA23	1926	1338	1906	1906	1906	PSP SS	CNT(2)(10)	OT	Direct
0856K 01	Circular Sect. Forging	CS100	1918	123	61	61	61	PSP SS		OT	Direct
0856K 02	Axles	CS100	1966	255	198	198	198	PSP SS	CNT(2)(4), CL,FLP	OT	Direct
0856K 03	Wheels	CS98 AS2	1971	732	1770	1770	1770	PSP SS	CNT(2)(95) CL,FLP	OT	Direct
0856N 01	Round, Rebar	CS65, ATS17,MS11 RAL5,BS2	1970	3348	3226	3226	3226	PSP SS	CNT(2)(50) SL(UNK)	OT	Direct
0856N 02	Rebar	CS65, ATS17,MS11 RAL5,BS2	1970	1722	6272	6272	6272	PSP SS	CNT(2)(50) SL(UNK)	OT	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton) Applied	Process	Discharge	Treatment Components Process Treatment	Central Treatment	Operating Mode	Discharge Mode
0856P	Rods	CS99 LA1	1955	1233	5656	5656	5656	PSP	CNT(2)(86) SSP,SS	OT	Direct
0856Q 01	Rounds	CS60, LA40	1932	2979	UNK	UNK	UNK	PSP SSP	CNT(2)(UNK) SS,SL(UNK)	OT	Direct
0856T 01	Round,Square	CS60 OS40	1906	1029	535	535	535	PSP		OT	Direct
0856U 01	Misc.Shapes	CS100	1925	204	14,894	14,894	14,894	PSP	CNT(2)(5) SSP,SS	OT	Direct
0856U 02	Misc. Shapes	CS100	1926	690	6699	6699	6699	PSP	CNT(2)(8) SSP,SS	OT	Direct
0856U 03	Angle,Flat Bar, Half Round,Other	CS95 LA5	1918	378	5638	5638	5638	PSP	CNT(2)(3.8) SSP,SS	OT	Direct
0856U 04	Flat Bar and Other Shapes	CS100	1918	225	12,288	12,288	12,288	PSP	CNT(2)(5) SSP,SS	OT	Direct
0856U 05	Square,Strip, Round,Spring Steel Flat Bar,Rebar, Other Shapes	CS80 LA20	1931	693	8125	8125	8125	PSP	CNT(2)(10) SSP,SS	OT	Direct
0860B 01	Billets,Round Square, Flat Bar	CS94 LA1,AS5	1971	2132	3309	3309	3309	PSP SS	CNT(2)(6.7) SS,SL(UNK)	OT	Direct
0860B 02	I-Beam,Channel Zee,Bulb Angle, Angle Special	CS94 LA1, AS5	1909	536	5909	5909	5909	PSP SS	CNT(2)(3) SS,SL(UNK)	OT	Direct
0860B 03	I-Beam,Channel Tee,Bulb Angle Square	CS94 LA1 AS5	1910	486	6522	6522	6522	PSP SS	CNT(2)(3) SL(UNK),SS	OT	Direct
0860B 04	Bar	CS94 LA1,AS5	UNK	1135	2663	2663	2663	PSP	CNT(2)(3) SS,SL(UNK)	OT	Direct
0860B 05	Tee,Angle,Flat Bar,Spec.Section	CS94 LA1,AS5	1911	429	9399	9399	9399	PSP	CNT(2)(4) SS,SL(UNK)	OT	Direct
0860B 06	Bulb Angle Square,Flat,Spec.	CS94 LA1,AS5	1911		IDLE					OT	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0860B 07	Round,Square Hex,Rebar,Spec.	UNK	1911	IDLE							
0860B 08	Round,Rebar	CS94 LS1,AS5	1919	492	11,993	11,993	11,993	PSP	CNT(2)(5.6) SS,SL(UNK)	OT	Direct
0860B 09	Channel,Angle Flat Bar,Strip	CS94 LS1,AS5	1927	474	7590	7590	7590	PSP	CNT(2)(3.4) SS,SL(UNK)	OT	Direct
0860B 10	Round, Flat Bar Rebar,Spec.Sect.	CS94 LA1,AS5	UNK	892	12,751	12,751	12,751	PSP	CNT(2)(10.8) SS,SL(UNK)	OT	Direct
0860B 11	Mill,Round,Flat Bar,Rebar	CS94 LA1,AS5	1972	1464	6880	6880	6880	PSP	CNT(2)(9.6) SS,SL(UNK)	OT	Direct
0860F 01	Wire Rods	CS97 LA3	1936	726	7934	7934	793	PSP SS	CNT(2)(25) SSP,T,VF,F, MA,ML,CT FDS(UNK)	RTP(90) BD(10)	Direct
0860F 02	Wire Rods	CS94 LA6	1943	1167	4936	4936	494	PSP SS	CNT(2)(25) SSP,T,VF,F MA,ML,CT, FDS(UNK)	RTP(90) BD(10)	Direct
0860H 01	WF-Beam	CS80 LA20	1931	2616	7796	7796	218	PSP SS	CNT(2)(18.7) SSP,SS,SCR, FLL,FLA,VF CL,T	RTP(97.2) BD(2.8)	POTW
0860H 02	WF-Beam,I-Beam Channel,Sheet Piling,Angle Zee	CS85 LA15	1959	1380	[4690]	[4690]	[180]	PSP SS	CNT(2)(22.7) SSP,SS,SCR FLL,FLA,VF CL,CT,T	RTP(96) BD(4.0)	POTW
0860H 03	Rod, Coils	CS99 ATS1	1974	2058	[6930]	[6930]	[3.5]	PSP,SSP SS,CT, E,FSP, VF,T		RTP(99.5) BD(0.5)	Indirect
0864A	Billets,WF- & I-Beam,Channel Zee,Angel	CS94 LA6	UNK	2040	10,729	10,729	933	PSP	CNT(2)(83) SS,CL SL(UNK)	RUP(78.9) RTP(12.3) BD(8.7)	Direct
0864B	Round	CS100	1941	1161	9054	9054	245	PSP	CNT(2)(1.6) ML,FLL,FLP CL,MA,SS,T	RUP(97.3) BD(2.7)	Direct
0864C 01	Billets,Channel Angle,Round,Flat Bar,Rebar	CS75 LA5,ATS20	1916	450	3840	3840	280	PSP SS	CNT(2)(29) SSP,SS,CT, SL(UNK)	RTP(92.7) BD(7.3)	Direct
0864C 02	Channel,Angle Round,Flat Bar Rebar	CS75 LA5 ATS20	1916	360	10,000	10,000	730	PSP SS	CNT(2)(61) SSP,CT,SS SL(UNK)	RTP(92.7) BD(7.3)	Direct

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Plant Code	Products	Steel Types	Age 1st yr. of Prod.	Production Capacity Ton/Day	Flow (Gallons/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0868A 01	Rails	CS100	1908	1902	1020	1020	1020	PSP	CNT(2)(23) SSP,SS, SL(UNK)	OT	Direct
0868A 02	Mill,Billets, Blooms	CS95 LA5	1912	2307	709	709	709	PSP	CNT(2)(23.5) SS,SSP, SL(UNK)	OT	Direct
0868A 03	I-Beam,Channel Bulb Angle,Angle.	CS95 LA5	1919	1386	1647	1647	224	PSP	CNT(2)(3.8) SSP,SS, SL(UNK)	RTP(86.4) BD(13.6)	Indirect
0868A 04	R.R.Axel	CS100	1923	249	3909	3909	532	PSP	CNT(2)(1.6) SS,SL(UNK)	RTP(86.4) BD(13.6)	Indirect
0868A 05	Round,Square Flat Bar,Rebar	CS98 LA2	1924	537	963	963	131	PSP	CNT(2)(0.85) SSP,SS, SL(UNK)	RTP(86.4) BD(13.6)	Indirect
0868A 06	Billets	CS95 LA5	1925		IDLE						
0920B 01	Round,Square	CS100	1908	1806	1037	1037	421	PSP	CNT(2)(13) SSP	RTP(59.4) BD(40.6)	Direct
0920B 02	Rounds	CS100	1910	516	1674	1674	1674	PSP		OT	Direct
0946A 01	Round,Square Flat Bar,Spec.	CS77, LA23	1907	759	7589	7589	1009	PSP	CNT(2)(22) SSP,FDSP	RTP(86.7) BD(13.3)	Direct
0946A 02	Round,Square Flat Bar,Misc.	CS25, LA65	1926	906	8742	8742	1609	PSP	CNT(2)(30) SSP,T,FLP FDSP	RTP(81.6) BD(18.4)	Direct
0946A 03	Round, Square Hex	CS80 LA20	1961	831	7798	7798	328	PSP SS		RTP(95.8) BD(4.2)	POTW
0948B	Rounds	CS56 LA44	1914	768	2625	2625	2625	PSP		OT	Direct
0948F 01	Round,Square Hex, Rebar	CS60 LA10,RAL30	1915	424	UNK	UNK	UNK	PSP SS		OT	Direct
0948F 02	Zee,Angle,Round Square,Hex,Rebar	CS60 LA8,RAL32	1916	583	UNK	UNK	UNK	PSP SS		OT	Direct
0948F 03		CS96 CB4	1933	29	3750	3750	3750	PSP		OT	Direct

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SUMMARY TABLE
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FOOTNOTES

(1) 1977 value

* : Dry Operation
**: Confidential Data
[]: Data listed in brackets was received in the responses to the detailed questionnaires or during sampling visits

Steel Types

CS : Carbon Steel
LA : Low Alloy Steel
SS : Stainless Steel
CMHR: Chrome/Muldenum Heat Resistant
OS : Other Steel Not Identified
ATS : Alloy Tool Steel
ES : Electrical Steel

AS : Alloy Steel
BS : Boron Steel
ABS: Alloy Bar Steel
FMS: Free Machining
RAL: Resulphurized and Leaded
VGS: Vanadium Grade Steel
MS : Managing Steel

Additional Footnotes

01: Decant Tank
02: Inclined Plate Separator
03: Settling Basin
04: Continuous Cloth Filter
05: Settling Tank
06: Flocculation w/Ferric Chloride

For a definition of other C&TT Codes, see Table VII-1.

TABLE III-4

GENERAL SUMMARY TABLE
HOT FORMING: FLAT-HOT STRIP AND SHEET

					Flow (Gallon/Ton)			Treatment Components			
Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Applied	Process	Discharge	Process Treatment	Central Treatment	Operating Mode	Discharge Mode
0020B	Plate, Hot Strip	SS-40 ES-60	1953	2,550	5,421	5,421	5,421	PSP	SSP,CL, FDS(UNK)	OT	Direct
0060	Hot Strip	CS-95 LA-5	1968 (1971)	10,032	[8,297]	[7,936]	[251]	PSP,SS	CNT2-82.6, FLL,FLO(1), CL,VF,CT	RUP-4,RTP-94, BD3	Direct
0060B	Hot Strip	CS-98.4 LA-1.6	1953 (1967)	4,790	UNK	UNK	UNK	PSP,SSP,SS	CNT2(UNK),NL, FLP,CL,VF,CT	RTP(UNK),RET (UNK),BD(UNK)	Direct
0060D	Hot Strip	CS-5.1 SS-22.4 ES-72.5	1958	2,520	7,143	7,143	UNK	PSP	CNT2(UNK), FLL,FLP,FL (01),CL,SL (UNK),CT	RTP(UNK), RET(UNK), BD(UNK)	Direct
0112A-03	Hot Strip, Skelp	CS-100	1937 (1960)	6,978	4,911	1,405	1,405	PSP,CT	CNT2(UNK),SS, Scr,AE,NL, FLA,FLP,SL (UNK),CY,T	RUP-71.4, BD-28.6	Direct
0112-04	Plate,Sheet, Hot Strip, Skelp	CS-95 LA-5	1947	7,893	5,619	584	584	PSP,CT	CNT2(UNK),SS Scr,AE,NL,FLA FLP,SL(UNK), CY,T	RUP-89.6, BD-10.4	Direct
0112B	Plate,Hot Strip,Sheet	CS-99.9 LA-0.1	1936 (1957)	7,368	UNK	UNK	UNK	PSP	CNT2(UNK),SS, FDS(UNK),T	RTP((UNK), BD(UNK)	Direct
0112D-02	Plate, Sheet	CS-98.6 LA-1.4	1966	12,744	[5,719]	[5,719]	[5,719]	PSP	CNT2-61.3, CL,FLP,NL, NW,CR,SL(UNK)	OT	Direct
0176	Hot Strip	SS+ES 100	1953	240	9,630	9,630	693	PSP	CNT2-13,SSP, T,SS,CY,CL	RTP-92.8, BD-7.2	Direct
0248B	Plate,Hot Strip,Slabs	CS-10 SS-90	1960	1,500	7,680	7,680	92	PSP,SSP	FLP,Scr,TP, CT,SS	RTP-98.8, BD-1.2	Direct

TABLE III-4
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-HOT STRIP AND SHEET
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Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0256C	Hot Strip	CS-86.15 SS-8.45 ES-5.4	1952 (1967)	2,328	UNK	UNK	UNK	PSP	CNT2(UNK),SL (UNK),SS	RTP(UNK), BD(UNK)	Direct
0256L-03 0256L-04	CONFIDENTIAL DATA										
0320-02	Sheet	CS-100	1974	8,232	9,951	6,737	6,737	PSP,SS	CNT2-52.7, MC,SC,CL, SL(UNK)	RUP-32.3, BD-67.7	Direct
0384A-02	Hot Strip	CS-96.2 LA-2.9 ES-0.9	1965 (1967)	12,291	10,193	7,380	7,380	PSP,SS	FLL,FLP,FLA, FLO(1),SS,CL	RUP-27.6, BD-72.4	Direct
0384A-03	Plate, Strip,Sheet	CS-83.9 LA-16.1	1932 (1958)	3,666	17,511	17,511	17,511	PSP	CNT2-31.8, SS,SL(UNK)	OT	Direct
0384A-04	Plate,Strip, Sheet	CS-98.8 LA-1.2	1938 (1960)	5,400	8,573	8,573	8,573	PSP	CNT2-23, SL(UNK),SS	OT	Direct
0396D-01	Hot Strip	CS-100	1927	231	24,935	24,935	UNK	PSP	CNT2(UNK), SL(UNK),SS	RTP(UNK), BD(UNK)	POTW
0396D-02	Hot Strip	CS-100	1960	1,638	7,033	7,033	UNK	PSP,CT,FDSP, CL,VF	CNT2(UNK),SS SL(UNK)	RTP(UNK), BD(UNK)	Indirect to POTW
0424-02	Plate, Sheet	CS-100	1950	20.1	716	716	716	-	CNT2(UNK), FDSP,SL(UNK), CT	OT	Direct
0432A	Hot Strip, Skelp	CS-90 LA-5 ES-5	1957	5,400	UNK	UNK	UNK	PSP,SS	CNT2(UNK), FLP,FLM,CL, SS,Scr,VF	OT	Direct
0432B	Plate, Hot Strip	CS-90 SS-10	1937	3,942	UNK	UNK	UNK	PSP,SS	-	OT	Direct

TABLE III-4
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-HOT STRIP AND SHEET
PAGE 3

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0432C	Plate,Hot Strip,Skelp	CS-92 SS-4 LA-4	1964	10,404	4,429	3,919	830	-	CNT2-65,PSP, SS,FLL,FLP, A,CL,VF,CT	RUP-11.5, RTP-69.8, BD-18.7	Direct
0448A-01	Plate, Skelp	CS-96 AS-4	1943 (1969)	2,417	UNK	UNK	UNK	PSP,SS	CNT2(UNK),CL, SL(UNK),CT	RUP(UNK), RTP(UNK), RET(UNK)	Indirect
0448-02	Plate,Hot Strip,Sheet Skelp	CS-95 AS-5	1950 (1969)	5,509	UNK	UNK	UNK	PSP,SS,CL, SL(UNK),CT	-	RUP(UNK), RTP(UNK), BD(UNK)	POTW
0476A	Plate,Sheet Hot Strip, Skelp, Bar	CS-80 LA-20	1915 (1960)	828	6,282	6,282	2,525	PSP	CNT2-60.7, SSP,Scr,SS, NL,FLP,CL, SL(UNK)	RTP-59.8, BD-40.2	Direct
0492A	Skelp	CS-100	1953	3,152	3,471	3,471	3,471	PSP,SSP	CNT2-9.8 SL(UNK),SS	RET100	Indirect
0528A	Hot Strip	CS-94 SS-3 LA-3	1955	5,549	4,686	4,686	4,686	PSP	CNT2-66,ASP CO,EB,FLP, NL,Scr,CL, T,SS	OT	Direct
0584B	Plate, Hot Strip	CS-80 LA-20	1961	14,022	5,370	5,370	5,370	PSP,SSP,SS	-	OT	Direct
0584C	Hot Strip	CS-80 LA-20	1967	9,375	3,680	3,680	3,680	PSP,S,SSP	CNT2-48.6, SS,SL(UNK), FDSP,CLB,SO2 dechlorination	OT	Direct
0584F	Hot Strip	CS-100	1927 (1955)	8,323	4,014	4,014	4,014	PSP	CNT2-40.7, SL(UNK),SS	OT	Direct

TABLE III-4
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-HOT STRIP AND SHEET
PAGE 4

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0684B	Plate, Hot Strip, Sheet, Skelp	CS-84 SS-5 LA-2 AT-1 ES-8	1961 (1964)	6,396	[4,503]	[4,503]	[1,463]	PSP, SL(UNK), CT	-	RTP-67.5, BD-32.5	Direct
0684F-02	Plate, Sheet, Skelp	CS-94 SS-2 LA-4	1971	8,223	9,347	7,378	327	PSP	CNT2-56.0, Scr, FLL, FLP, FLO(1), CL, SS, SL(UNK), FDS (UNK), CT, VF	RUP-18.9, RTP-77.6 BD+Losses-3.5	Direct
0684I-01	Hot Strip	CS-96 LA-4	1957 (1964)	3,429	5,802	5,802	5,288	PSP	CNT2-13.8, SSP, SS, BOA1, NW, SL(UNK), SS	RTP-8.9, BD-91.1	Direct
0684V-02	Sheet	SS-100	1916	20.7	8,803*	8,803*	403*	PSP, SS, SL(UNK)	-	RTP-95.4, RET-4.6	Indirect
0776H-02	Sheet	SS-10 LA-15 AT-75	1902 (1962)	18	6,400	6,400	6,400	PSP	-	OT	Direct
0856D	Hot Strip	CS-85 LA-11 ES-4	1938 (1961)	8,445	4,450	4,450	4,450	-	PSP, SS	OT	Direct
0856E	Plate, Sheet	SS-100	1927	28	UNK	UNK	UNK	-	-	OT	Direct
0856F-01	Hot Strip	CS-100	1952	9,168	5,497	4,238	4,238	PSP	CNT2-45, GF, SC, FLP, BOA(1), SL (UNK), SS	RUP-22.9, BD-77.1	Direct
0856F-02	Skelp	CS-100	1953	3,042	2,840	947	947	PSP	CNT2-3.3, GF, SC, FLP, BOA(1), SL (UNK), SS	RUP-66.7, BD33.3	Direct

TABLE III-4
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-HOT STRIP AND SHEET
PAGE 5

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0856P	Hot Strip	CS-100	1929	253	5,125	5,125	5,125	PSP,SS	CNT2-98, SSP,SS	OT	Direct
0856U-01	Hot Strip, Skelp,Bar	CS-100	1929	558	11,277	11,277	11,277	PSP	CNT2-11.3, SSP,SS	OT	Direct
0856U-02	Hot Strip, Specials	CS-100	1918	150	22,944	22,944	22,944	PSP	CNT2-6.9, SSP,SS	OT	Direct
0856U-03	Hot Strip	CS-95 LA-5	1920	639	6,400	6,400	6,400	PSP	CNT2-7.3, SSP,SS	OT	Direct
0856U-04	Plate,Hot Strip,Skelp, Bar	CS-100	1926	915	4,847	4,847	4,847	PSP	CNT2-7.9, SSP,SS	OT	Direct
0856U-05	Plate,Hot Strip,Sheet, Skelp	CS-85 LA-15	1935	2,907	11,809	11,809	11,809	PSP	CNT2-61.4, SSP,SS	OT	Direct
0860B-01	Hot Strip	CS-96.5 SS-2 LA-1.5	1967	12,204	8,448	7,510	7,510	PSP,SS	CNT1-79.8, SSP,SS,FDSP, T,VF	RUP-11.1, BD-88.9	Direct
0860B-02	Hot Strip	CS-100	1936 (1976)	5,895	5,594	5,594	5,594	PSP,SS	CNT1-20.2, SSP,SS, FDSP,T,VF	OT	Direct
0864A	Plate,Hot Strip,Sheet	CS-94.8 LA-5.2	1944 (1971)	6,018	4,666	4,666	4,666	PSP	CNT2-50.4, CL,SS, SL(UNK)	RET-58.7, BD-41.3	Direct
0868A-02	Hot Strip	CS-100	1929	177	21,356	18,443	1,815	PSP	CNT2-5.4, SSP,SS, SL(UNK)	RUP-13.6, RTP-77.9, BD-8.5	Direct
0868A-03	Hot Strip	CS-99 LA-1	1937 (1969)	4,854	2,905	2,905	334	PSP	CNT2-23.3, SSP,SS, SL(UNK)	RTP-88.5, BD-11.5	Direct

TABLE III-4
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-HOT STRIP AND SHEET
PAGE 6

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0920C	Hot Strip	CS-99.5 LA-0.25 HCS-0.25	1953 (1964)	3,300	7,767	5,150	5,150	PSP,SS, SSP,SS	-	RUP-33.7, BD-66.3	Direct
0920H	Hot Strip	CS-96 LA-4	1966	7,992	[3,198]	[1,892]	[1,892]	PSP,SS, FDMP	-	[RUP-40.8, BD-59.2]	Direct
0948A	Plate,Hot Strip,Sheet, Skelp	CS-89 LA-10 ES-1	1935 (1960)	7,584	6,076	6,076	6,076	PSP,SS	-	OT	Direct
0948C	Plate,Hot Strip,Sheet, Skelp	CS-95 LA-5	1968	8,724	6,602	6,602	6,602	PSP,SS	CNT2-97.6, FDSP,CL, FLO(1),SS	RET-100	Indirect

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*: Includes flows from one plate mill.
( ) Dates in parentheses represent years in which the mill went through a major modification.
[ ] Data listed in brackets was received in the response to the detailed questionnaires or during sampling visits.

KEY TO C&TT STEPS

AS : Alloy Steel
CS : Carbon Steel
HCS: High Carbon Steel
SS : Stainless Steel
AT : Alloy Tool
ES : Electrical Steel
LA : Low Alloy
SAS: Super Alloy Steel

For definitions of C&TT codes see Table VII-1.

TABLE III-5

GENERAL SUMMARY TABLE
HOT FORMING: FLAT-PLATE (CARBON)

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton) Applied	Flow (Gallon/Ton) Process	Flow (Gallon/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0060F-01	Plate	CS-73 LA-16 AS-11	1962	2,115	3,976	3,976	UNK	PSP	CNT2(UNK), SSP,Scr, SL(UNK),SS	RTP(UNK), RET(UNK), BD(UNK)	Direct
0060F-02	Plate	CS-73 LA-16 AS-11	1950	1,410	UNK	UNK	UNK	PSP	CNT2(UNK), SSP,SL(UNK), Scr,SS	RTP(UNK), RET(UNK) BD(UNK)	Direct
0112A-01	Plate	CS-100	1920 (1964)	1,056	2,455	2,455	2,455	PSP,SS	CNT2(UNK) SS,Scr,AE, NL,FLA,FLP, SL(UNK),CT,T	OT	Direct
0112A-02	Plate	CS-98 TS-2	1931 (1957)	2,592	2,778	2,778	2,778	PSP,SS	CNT2(UNK), Scr,AE,NL,SS, FLA,FLP,SL (UNK),CT,T	OT	Direct
0112C-01	Plate	CS-82.7 AS-17.3	1902 (1954)	834	UNK	UNK	UNK	PSP	CNT2(UNK), NC,AE,SSP,SS, T,FDS(UNK), CT	OT	Direct
0112C-02	Plate	CS-69.7 AS-30.3	1906 (1961)	471	UNK	UNK	UNK	PSP	CNT2(UNK), NC,AE,SSP,SS, T,FDS(UNK), CT	OT	Direct
0112D-01	Plate	CS-70 LA-15 AS-15	1964	3,360	UNK	[3,221]	[3,221]	PSP,SS	CNT2-12.2, SS,CL,FLP, NL,NW,CR, SL(UNK)	RUP(UNK) BD(UNK)	Direct
0384A-01	Plate	CS-74.7 LA-25.3	1913 (1951)	972	7,867	7,867	7,867	PSP,SSP, SS	CNT2-93, SL(UNK),SS	OT	Direct

TABLE III-5
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-PLATE (CARBON)
PAGE 2

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0496 112"/120"	Plate	Carbon	1904 (1943)	1,740	869	869	869	PSP,SSP, SS	CNT1-28, FLP,DR,FDMG	OT	Direct
0496 140"	Plate	Carbon	1959 (1968)	1,830	118	118	118	PSP,SSP, SS	CNT1-4, FLP,DR,FDMG	OT	Direct
0684I-02	Plate	CS-76 LA-24	1967	1,629	7,558	7,558	6,889	PSP	CNT2-13.9, SSP,SS, BOA(1),NW, SL(UNK),SS	RTP-8.9, BD-91.1	Direct
0856H-01	Plate	CS-72.1 LA-27.9	1898	984	117	117	117	PSP,SSP, SS	-	OT	Direct
0856H-02	Plate	CS-87.4 LA-12.1 AT-0.5	1936	3,939	5,473	5,473	5,473	PSP	-	OT	Direct
0856H-03	Plate	CS-73.5 SS-1.5 LA-13.5 AT-11.5	1944	2,916	3,652	3,652	3,652	PSP,SS	-	OT	Direct
0860B-03	Plate	CS-67 AS-33	1962	3,162	2,550	2,550	2,550	PSP,SP	CNT2-7.5, SL(UNK), SS	OT	Direct
0860H-01	Plate	CS-50 LA-42 AT-8	1907 (1973)	648	[9,821]	[9,821]	[367]	PSP,SS	CNT2-5.3, Scr,CL,CT, T,FLL,VF,FLA SSP,SS	RTP-96.3, BD-3.7	POTW

TABLE III-5
GENERAL SUMMARY TABLE
HOT FORMING: FLAT-PLATE (CARBON)
PAGE 3

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0860H-02	Plate, Floor Plate	CS-60 LA-40	1931	2,886	5,489	5,489	154	PSP,SS	CNT2-14.7, Scr,SSP,SG CL,T,CT,FLL, VF,FLA	RTP-97.2, BD-2.8	POTW
0868A-01	Plate	CS-80 LA-20	1919 (1942)	1,800	3,922	3,922	451	PSP	CNT2-11.7, SL(UNK), SS,SSP	RTP-88.5, BD-11.5	Direct
0868B	Plate	CS-85 LA-10 AT-5	1970	3,894	4,992	4,992	185	PSP,SS	CNT2-99.3, FLP,A,SS, SSP,SL(UNK), F(UNK)(UNK)P	RTP-96.3, BD&Losses- 3.7	Direct

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( ) Dates in parentheses represent years in which the mill went through a major modification.
[] Data listed in brackets was received in the responses to the detailed questionnaires or during sampling visits.

KEY TO C&TT STEPS

AS : Alloy Steel
CS : Carbon Steel
SS : Specialty Steel
TS : Titanium Steel

AT : Alloy Tool
LA : Low Alloy
SAS: Super Alloy Steel

NOTE: For definitions of C&TT codes see Table VII-1.

TABLE III-6

GENERAL SUMMARY TABLE
HOT FORMING: FLAT-PLATE (SPECIALTY)

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton) Applied	Flow (Gallon/Ton) Process	Flow (Gallon/Ton) Discharge	Treatment Components Process Treatment	Treatment Components Central Treatment	Operating Mode	Discharge Mode
0256L-01 0256L-02	CONFIDENTIAL DATA										
0424-01	Plate	SS-78 AT-14 TS-8	1971	450	800	800	800	PSP,SS, SSP	CNT2-14, FDSP,SS, SL(UNK),CT	RET-61.5 BD-38.5	Direct
0496 (112"/ 120")	Plate	SS and LA	1904 (1943)	1,740	[2,653]	[2,653]	[2,653]	PSP,SSP, SS	CNT1-28, FLP,DR,FDMG	OT	Direct
0496 (140")	Plate	SS and LA	1959 (1968)	1,830	[870]	[870]	[870]	PSP,SSP, SS	CNT1-4, FLP,DR,FDMG	OT	Direct
0496 (140"/ 206")	Plate	SS and LA	1918	630	206	206	206	PSP,SSP, SS	CNT1-24, FLP,DR, FDMG	OT	Direct
0684V-01	Plate	SS-86 AS-14	1916	119.4	8,803*	8,803*	403*	PSP,SS, SL(UNK)	-	RTP-95.4, RET-4.6	Indirect
0776H-01	Plate	SS-10 LA-15 AT-75	1902	60	960	960	960	PSP	-	OT	Direct

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* : Includes flow from one sheet mill.
( ) Dates in parentheses represent years in which the mill went through a major modification.
[ ] Data listed in brackets was received in the responses to the detailed questionnaires or during sampling visits.

KEY TO C&TT STEPS

AS : Alloy Steel
CS : Carbon Steel
SS : Specialty Steel
TS : Titanium Steel
AT : Alloy Tool
LA : Low Alloy
SAS: Super Alloy Steel

For definitions of C&TT codes see Table VII-1.

TABLE III-7

GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0060C 01	Seamless Pipe	CS - 60 HSLA - 40	1913	906	UNK	UNK	UNK	PSP, SS	CNT 2(UNK), FLP,SSP, SS	RTP(UNK), BD(UNK)	Direct
0060C 02	Seamless Pipe	CS-45 HSLA-55	1913	408	UNK	UNK	UNK	PSP,SS	CNT2(UNK), FLP,SSP, SS	RTP(UNK), BD(UNK)	Direct
0060F	Butt Weld Pipe	CS-10 HSLA-90	1950	1044	(No production in 1976)			-	-	-	-
0060R 01	Butt Weld Pipe	CS-100	1930	63.9	UNK	UNK	0	SL(UNK), PSP	-	RTP100	Zero Discharge
0060R 02	Butt Weld Pipe	CS-100	1947	63.9	UNK	UNK	0	PSP, SL(UNK)	-	RTP100	Zero Discharge
0088A 01	Seamless Tube	CS-14.0 SS-3.5 HSLA-40.0 CMNR-42.5	1914	285	UNK	UNK	UNK	PSP	CNT 1(UNK), SSP,SS, Straw Filter	OT	Direct
0088A 02	Seamless Pipe	CS-10.5 HSLA-40.0 CMNR-49.5	1917	252	UNK	UNK	UNK	PSP	CNT 1(UNK), SSP,SS, Straw Filter	OT	Direct

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 2

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0088A 03	Seamless Tube	CS-7 HSLA-93	1932	171	2712	2712	2712	PSP	-	OT	Direct
0088C 01	Seamless Tube	CS-60 HSLA-40	1910	283.8	3552	3552	1369	PSP,SSP, SS	CNT 2-33.7, GF,CT	RTP-61.4, BD-38.6	Direct
0088C 02	Seamless Tube	CS-60 HSLA-40	1937	268.5	6436	6436	2481	PSP,SSP, SS			
0112A 01	Butt Weld Pipe	CS-100	1939	366	UNK	UNK	UNK	PSP,SS	CNT2(UNK), Scr,NL, A,FLA,FLP, SL(UNK),SS, T,CT	OT	Direct
0112A 02	Butt Weld Pipe	CS-100	1940	744	UNK	UNK	UNK	PSP,SS	CNT2(UNK), Scr,NL,A, FLA,FLP, SL(UNK),SS, T,CT	OT	Direct
0196A	Seamless Tube	CS-95 HSLA-5	1953	**	12,794	12,794	4,572	PSP,SS	CNT2-32.9, SSP,SS, SL(UNK), CL,FDSP,CT	BD-35.7 RTP-64.3	Direct

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 3

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0240B 05	Seamless Pipe	CS-34 AS-66	1925	213	[1858]	[1858]	[231]	PSP,Oil Separator	SL(UNK)	RTP-87.5, BD-12.5	Direct
0256G	Butt Weld Pipe	CS-97 HSLA-3	1958	564	[515]	[515]	[515]	PSP,SSP, SS	-	OT	Direct
0396E	Butt Weld Pipe	CS-80 AS-20	1947	480	450	450	41	-	CNT2-1.8 SL(UNK)	RTP-91, BD-9.0	Direct
0432A 01	Butt Weld Pipe and Welded Tube	CS-100	1957	699	[8084]	[8084]	[8084]	PSP,SS	CNT 2(11.6) FLP,FLM, CL,SS,Scr, VF	OT	Direct
0432A 02	Butt Weld Pipe and Welded Tube	CS-100	1958	1029.6	UNK	UNK	UNK	PSP,SS	CNT 2(UNK), FLP,FLM, CL,SS,Scr, VF	OT	Direct
0432A 03	Seamless Pipe	CS-70 HSLA-30	1927	828	UNK	UNK	UNK	PSP	-	OT	Direct

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 4

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0432A 04	Seamless Pipe and Tube	CS-70 HSLA-30	1928	516	UNK	UNK	UNK	PSP	-	OT	Direct
0448A	Butt Weld Pipe	CS-100	1948	456.3	UNK	UNK	UNK	PSP,SS	CNT 2(UNK), CL,SL(UNK), CT	RUP(UNK), RTP(UNK), BD(UNK)	Direct
0476A	Butt Weld Pipe	CS-100	1930	381.6	4672	887	887	PSP	CNT2-9.9, Scr,SS,NL, CT,FLP,CL	RUP-78.7, BD-19.1, Losses 2.2	Direct
0492A 05	Seamless Tube	CS-5 HSLA-95	1975	156	10154	10154	8237	PSP,SSP, SS	CNT2-1.4, SL(UNK), SS	RTP-18.9, RET-81.1	Indirect:no discharge from total system
0548	Seamless Tube	CS-90 AS-10	1945	196.8	4573	915	915	PSP	CNT2-27.1, NL,SL(UNK), GF,FLL,NA	RUP-80, BD-20	Direct
0548A 01	Seamless Pipe	CS-70 LA-30	1960	126	8000	8000	1794	PSP,SSP, SS	CNT2-77.8, Spray Cooling	RTP-77.6 RET-22.3 BD-0.1	Direct

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 5

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0548A 02	Seamless Pipe and Tube	CS-70 LA-30	1957	42	6857	6857	3429	-	CNT 2-22.2, Spray Cooling	RTP-50, RET-49, BD-1	Direct
0652A	Seamless Tube	CS-83 HSLA-17	1954	363	[3672]	[3672]	[3672]	PSP,SSP, SS	-	OT	Direct
0684A 02	Butt Weld Pipe	CS-100	1966	1002	4311	4311	4311	PSP,SS	-	OT	Direct
0684H	Seamless Tube	CS-50 HSLA-50	1953	540	[7013]	[7013]	[21]	PSP,SS	CNT2-8.9, FDSP,VF, FLL,FLP, CT,CL,T	RTP-99.7	POTW
0728	Butt Weld Pipe	CS-100	1929	240	[2560]	[2560]	[82]	-	CNT 2-96.8, PSP,SSP, SL(UNK),CT	RTP-96.8, RET-3.2	Indirect-Complete Recycle and Reuse
0796A 01	*	*	*	*	*	*	*	*	*	*	*
0796A 02	*	*	*	*	*	*	*	*	*	*	*

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 6

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0796A 03	*	*	*	*	*	*	*	*	*	*	*
0796B	*	*	*	*	*	*	*	*	*	*	*
0856C	Seamless Pipe	CS-90 HSLA-1 AS-9	1972	36	16,000	100	100	PSP	-	RUP-99.4, BD-0.6	Direct
0856F 01	Butt Weld Pipe	CS-100	1953	663	7,111	3,556	3,556	PSP	CNT2-6.7, GF,SSP>FLP, BOA(1), SL(UNK),SS	RUP-50 BD-50	Direct
0856F 02	Butt Weld Pipe	CS-100	1963	957							
0856H 01	Seamless Pipe	CS-100	1928	1011	3418	3418	3418	PSP	CNT 2-9.4, SL(UNK),SS	OT	Direct

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 7

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0856N 02	Seamless Pipe	CS-85 HSLA-15	1930	1500	3648	3648	3648	-	CNT2-10.7, SL(UNK), SS	OT	Direct
0856N 03	Seamless Pipe	CS-90 HSLA-10	1949	981	3083	3083	3083	PSP	CNT 2-5.9, SL(UNK), SS	OT	Direct
0856N 04	Butt Weld Pipe	CS-100	1960	888	3730	3730	3730	PSP	CNT 2-6.5, SL(UNK), SS	OT	Direct
0856Q 01	Seamless Pipe	CS-100	1930	927	UNK	UNK	UNK	PSP,SSP	CNT 2(UNK), SL(UNK),SS	OT	Direct
0856Q 02	Seamless Pipe	CS-100	1930	1365	UNK	UNK	UNK	PSP,SSP	CNT 2(UNK), SL (UNK), SS	OT	Direct
0916A 01	Butt Weld Pipe	CS-100	1931	600	2765	2765	2765	PSP,SS, FD(UNK) P, SL(UNK)	-	OT	Direct

TABLE III-7
GENERAL SUMMARY TABLE
HOT WORKING PIPE AND TUBE
PAGE 8

Plant Code	Product	Steel Type	Age - 1st Year of Prod.	Production Capacity (Tons/Day)	Flow (Gallon/Ton)			Treatment Components		Operating Mode	Discharge Mode
					Applied	Process	Discharge	Process Treatment	Central Treatment		
0920C 01	Seamless Tube	CS-85 HSLA-15	1934	229.5	4706	4235	4235	PSP	CNT 2-19.7, MC,SSP, SS	OT (losses)	Direct
0920C 02	Seamless Tube	CS-85 HSLA-15	1945	373.2	5788	5209	5209	PSP	CNT 2-39.5, MC,SSP,SS	OT (losses)	Direct
0920C 03	Seamless Tube	CS-85 HSLA-15	1924	111.3	Not in Operation in 1976 NA	NA	NA	PSP	CNT 2-19.7, MC,SSP,SS	OT (losses)	Direct
0948A 01	Seamless Tube	CS-60 HSLA-40	1926	615	6207	6207	6207	PSP	CNT 1-60, SSP,SS	OT	Direct
0948A 02	Seamless Tube	CS-70 HSLA-30	1926	777							
0948A 03	Butt Weld Pipe	CS-97 AT-3	1939	468	3077	3077	3077	PSP	-	OT	Direct
0948C 01	Seamless Pipe	CS-80 HSLA-20	1957	444	21.405	21,405	21,405	PSP,SS	-	OT	Direct
0948C 02	Butt Weld Pipe	CS-90 AT-10	1950	501	6611	6611	6611	PSP,SSP, SS,FDSP	-	OT	Direct

---

*: Confidential Information

NOTE: For the definition of the treatment component symbols, refer to Table VII-1.

TABLE III-8

HOT FORMING-PRIMARY
CARBON AND SPECIALTY STEELS
DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity[1] of Operations (Tons)	Total Daily Capacity
Operations Sampled for Original Study	13	10.0	48,084	10.4
Operations Sampled for Toxic Pollutant Study	5, incl. 1 above	3.9 0.8	14,673 incl. 5,565 above	3.2 1.2
Total Operations Sampled	17	13.1	57,192	12.4
Operations Selected for D-DCP	9, incl. 2 above	6.9 1.5	44,685 12,063	9.7 2.6
Operations Sampled and/or Solicited via D-DCP	24	18.5	89,814	19.5
Operations Responding to DCP	111[2]	85[3]	423,332	92.0
Estimated Number of Hot Forming-Primary Operations	130	100	460,000	100

---

[1] 1976 capacities were used for the values in this column.

[2] Responses were received from 114 operations, three of which were reported to be idle. Data is included in the totals from five operations which requested confidential treatment.

[3] Responses were solicited and received from approximately 85% of all active Hot Forming - Primary operations.

TABLE III-9

HOT FORMING SECTION
CARBON AND SPECIALTY STEELS
DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity[(1)] of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original guidelines study	25	8.9	21,309	7.6
Operations sampled for toxic pollutant study	13 incl. 4 above	4.6 incl. 1.4 above	15,581 incl. 287 above	5.6 incl. 0.1 above
Total operations sampled	34	12.1	36,603	13.1
Operations selected for detailed DCP	10 incl. 1 above	3.5 incl. 0.4 above	9464 incl. 2058 above	3.4 incl. 0.7 above
Operations sampled and/or solicited via detailed DCP	43	15.2	44,009	15.8
Operations responding to basic DCP	240(2)	85(3)	236,809	85
Estimated number of hot forming section operations	282	100	278,599	100

---

(1) 1976 capacities were used for the values in this column.

(2) Responses from 242 operations were received; however, two of those operations were reported to be idle. This number includes confidential operations.

(3) It has been estimated that responses have been received from 85% of the active section operations in the United States.

TABLE III-10

HOT FORMING FLAT
HOT STRIP AND SHEET
CARBON AND SPECIALTY STEELS
DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity[1] of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original guidelines study	7	10.8	40,455	13.2
Operations sampled for toxic pollutant study	2	3.1	17,694	5.8
Total operations sampled	9	13.8	58,149	19.0
Operations selected for detailed DCP	7 incl. 2 above	10.8 incl. 3.1 above	48,795 incl. 10,272 above	15.9 incl. 3.4 above
Operations sampled and/or solicited via detailed DCP	14	21.5	96,672	31.6
Operations responding to basic DCP	55[2]	85[3]	260,324	85.0
Estimated number of hot forming flat operations	65	100.0	306,264	100.0

---

(1) 1976 capacities were used for the values in this column.
(2) Responses from 57 operations were received, however, 2 of these operations were reported to be idle. This number includes confidential plants.
(3) It has been estimated that responses have been received from approximately 85% of the active flat operations in the United States.

TABLE III-11

HOT FORMING FLAT
PLATE
CARBON AND SPECIALTY STEELS
DATA BASE

	No. of Operations	% of Total No. of Operations	Daily Capacity[1] of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original guidelines study	2	6.3	6810	16.3
Opérations sampled for toxic pollutant study	7	21.9	15,948	38.3
Total operations sampled	9	28.1	22,758	54.6
Operations selected for detailed DCP	2	6.3	2537	6.1
Operations sampled and/or solicited via detailed DCP	11	34.4	25,295	60.7
Operations responding to basic DCP	27	85[2]	35,414	85.0
Estimated number of hot forming flat operations	32	100.0	41,664	100.0

---

(1) 1976 capacities were used for the values in this column.

(2) It has been estimated that responses have been received from approximately 85% of the active flat operations in the United States.

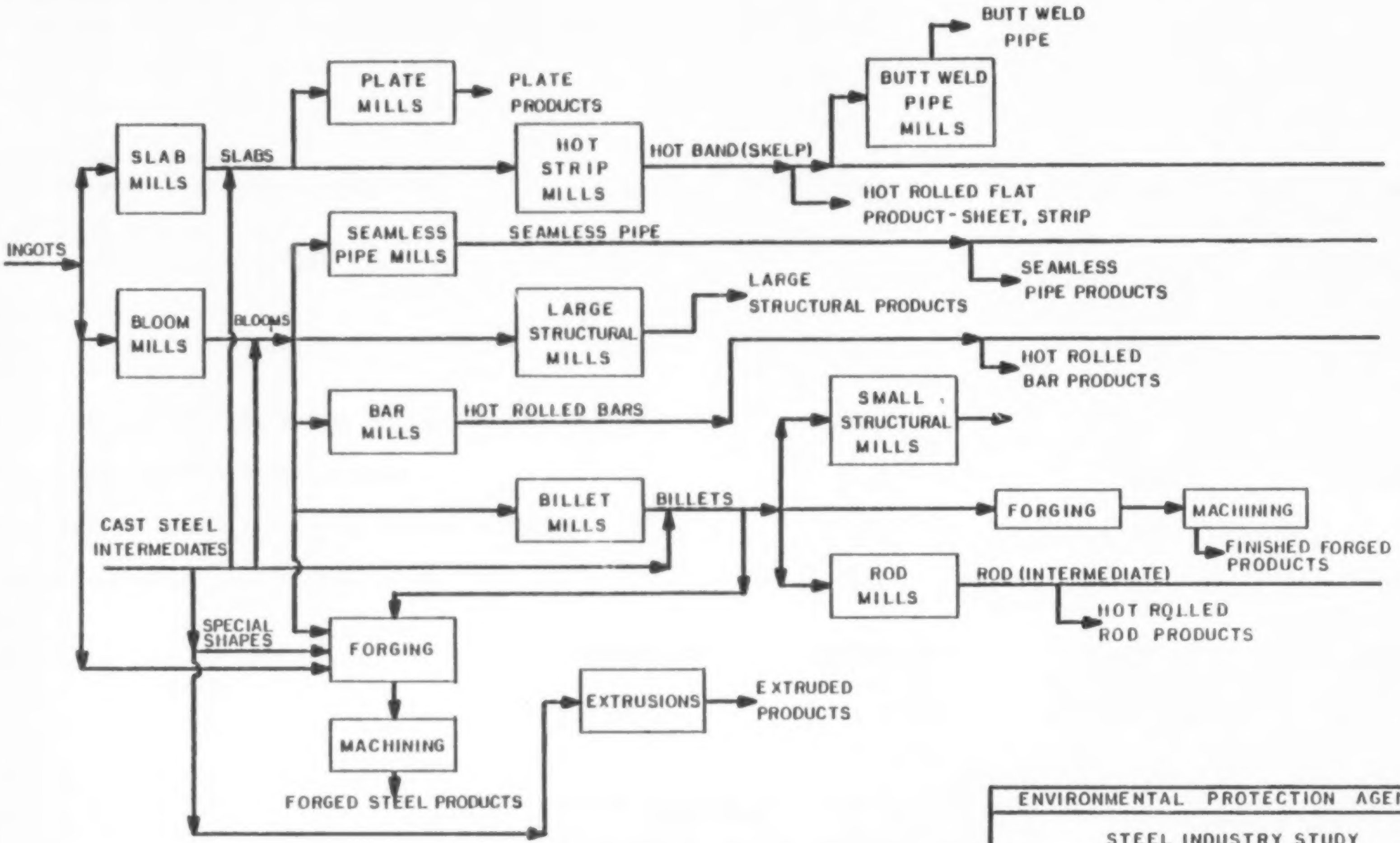
TABLE III-12

HOT WORKING PIPE AND TUBE
CARBON AND SPECIALTY STEELS
DATA BASE

	Number of Operations	% of Total Number of Operations	Daily Capacity of Operations (Tons)	% of Total Daily Capacity
Operations sampled for original study	5	8.2	2,439	7.9
Operations sampled for toxic pollutant study	2	3.3	1,239	4.0
Total number of operations sampled	7	11.5	3,678	11.9
Operations selected for the detailed DCP	3	4.9	816	2.6
Operations sampled and/or solicited via detailed DCP	8(1)	13.1(1)	4,041	13.1
Operations responding to the basic DCP	52(2)	85(3)	26,202(4)	85
Estimated number of hot working pipe and tube operations	61	100	30,826	100

---

(1) Two operations were sampled AND surveyed via detailed questionnaire.
(2) Includes two operations reported as idle.
(3) It has been estimated that responses were received from eighty-five percent of the hot working pipe and tube operations in the United States.
(4) This number does not include data from the two operations reported as idle.

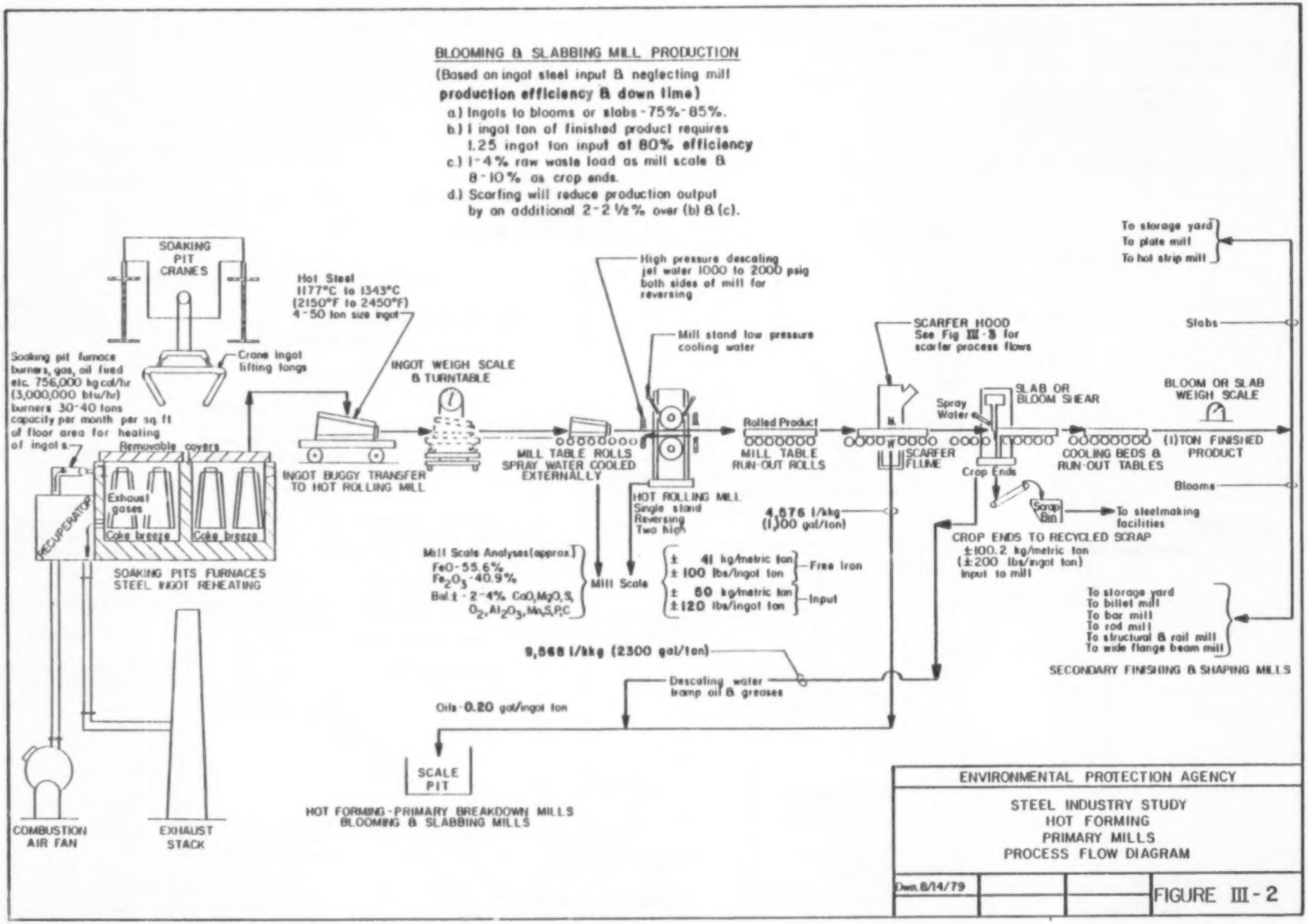

INGOTS
SLAB MILLS
BLOOM MILLS
SLABS
BLOOMS
CAST STEEL INTERMEDIATES
SPECIAL SHAPES
PLATE MILLS
PLATE PRODUCTS
HOT STRIP MILLS
HOT BAND (SKELP)
BUTT WELD PIPE MILLS
BUTT WELD PIPE
HOT ROLLED FLAT PRODUCT-SHEET, STRIP
SEAMLESS PIPE MILLS
SEAMLESS PIPE
SEAMLESS PIPE PRODUCTS
LARGE STRUCTURAL MILLS
LARGE STRUCTURAL PRODUCTS
HOT ROLLED BAR PRODUCTS
BAR MILLS
HOT ROLLED BARS
SMALL STRUCTURAL MILLS
BILLET MILLS
BILLETS
FORGING
MACHINING
FINISHED FORGED PRODUCTS
ROD MILLS
ROD (INTERMEDIATE)
HOT ROLLED ROD PRODUCTS
FORGING
MACHINING
FORGED STEEL PRODUCTS
EXTRUSIONS
EXTRUDED PRODUCTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
PROCESS FLOW DIAGRAM

Dwn. 4/25/79

FIGURE III-1


SOAKING PIT CRANES
Crane ingot lifting tongs
Soaking pit furnace burners, gas, oil fired etc. 756,000 kg cal/hr (3,000,000 btu/hr) burners 30-40 tons capacity per month per sq. ft of floor area for heating of ingots
Removable covers
Exhaust gases
Coke breeze
Coke breeze
RECUPERATOR
SOAKING PITS FURNACES STEEL INGOT REHEATING
COMBUSTION AIR FAN
EXHAUST STACK
Hot Steel 1177°C to 1343°C (2150°F to 2450°F) 4-50 ton size ingot
INGOT BUGGY TRANSFER TO HOT ROLLING MILL
INGOT WEIGH SCALE & TURNTABLE
MILL TABLE ROLLS SPRAY WATER COOLED EXTERNALLY
High pressure descaling jet water 1000 to 2000 psig both sides of mill for reversing
Mill stand low pressure cooling water
HOT ROLLING MILL Single stand Reversing Two high
Mill Scale Analyses (approx.)
FeO-55.6%
Fe2O3-40.9%
Bal.± 2-4% CaO, MgO, S, O2, Al2O3, Mn, S, P, C
Mill Scale
± 41 kg/metric ton
± 100 lbs/ingot ton
Free Iron
± 50 kg/metric ton
± 120 lbs/ingot ton
Input
Rolled Product
MILL TABLE RUN-OUT ROLLS
4,576 l/kkg (1,100 gal/ton)
SCARFER HOOD See Fig III-3 for scarfer process flows
SCARFER FLUME
Spray Water
SLAB OR BLOOM SHEAR
Crop Ends
Scrap Bin
To steelmaking facilities
CROP ENDS TO RECYCLED SCRAP
±100.2 kg/metric ton
(±200 lbs/ingot ton)
Input to mill
COOLING BEDS & RUN-OUT TABLES
BLOOM OR SLAB WEIGH SCALE
(1) TON FINISHED PRODUCT
Slabs
Blooms
To storage yard
To plate mill
To hot strip mill
To storage yard
To billet mill
To bar mill
To rod mill
To structural & rail mill
To wide flange beam mill
SECONDARY FINISHING & SHAPING MILLS
9,568 l/kkg (2300 gal/ton)
Descaling water tramp oil & greases
Oils-0.20 gal/ingot ton
SCALE PIT
Dwn. 8/14/79

BLOOMING & SLABBING MILL PRODUCTION

(Based on ingot steel input & neglecting mill **production efficiency & down time**)

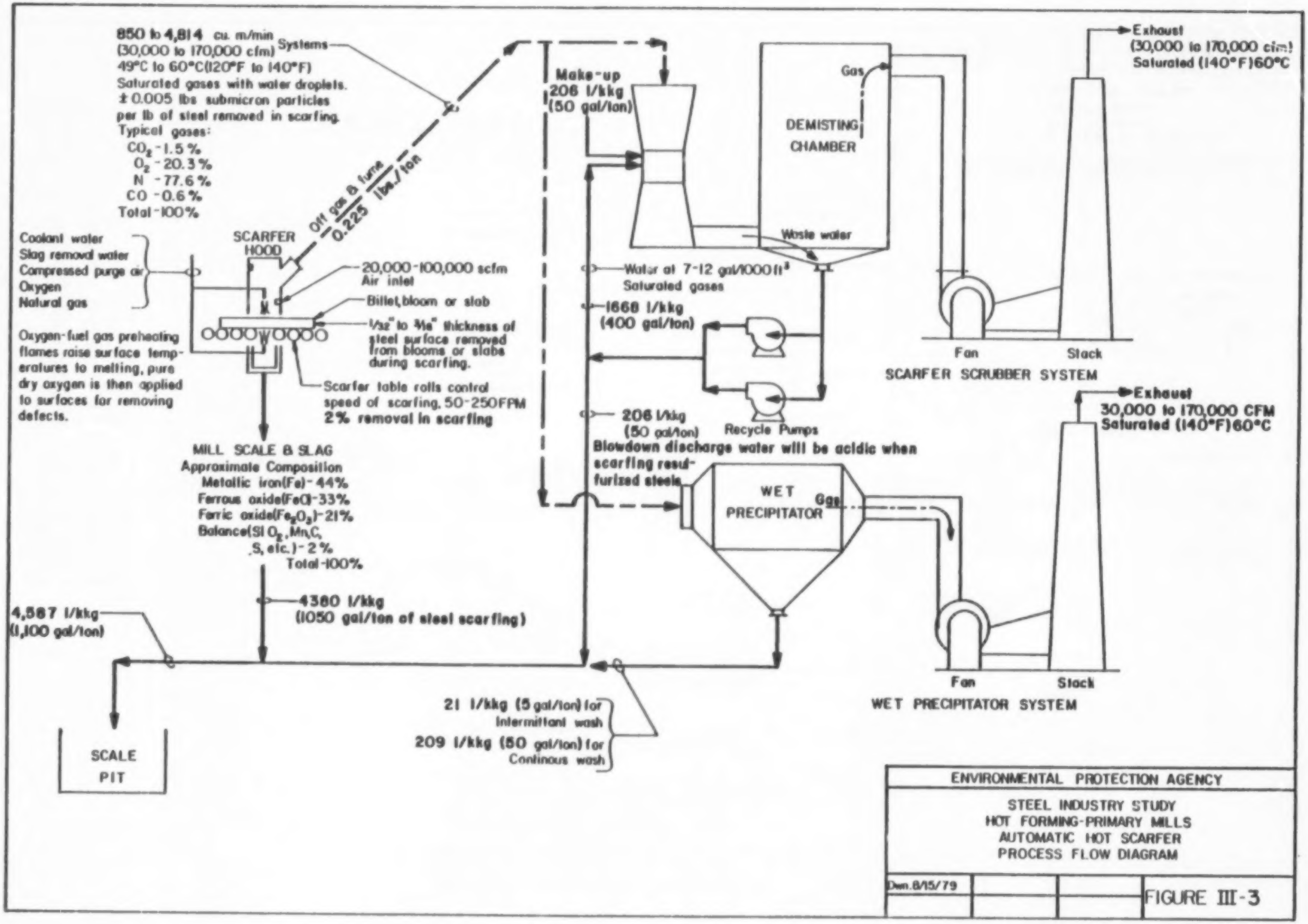
a.) Ingots to blooms or slabs - 75%-85%.
b.) 1 ingot ton of finished product requires 1.25 ingot ton input **at 80% efficiency**
c.) 1-4% raw waste load as mill scale & 8-10% as crop ends.
d.) Scarfing will reduce production output by an additional 2-2 ½% over (b) & (c).

HOT FORMING - PRIMARY BREAKDOWN MILLS
BLOOMING & SLABBING MILLS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
PRIMARY MILLS
PROCESS FLOW DIAGRAM

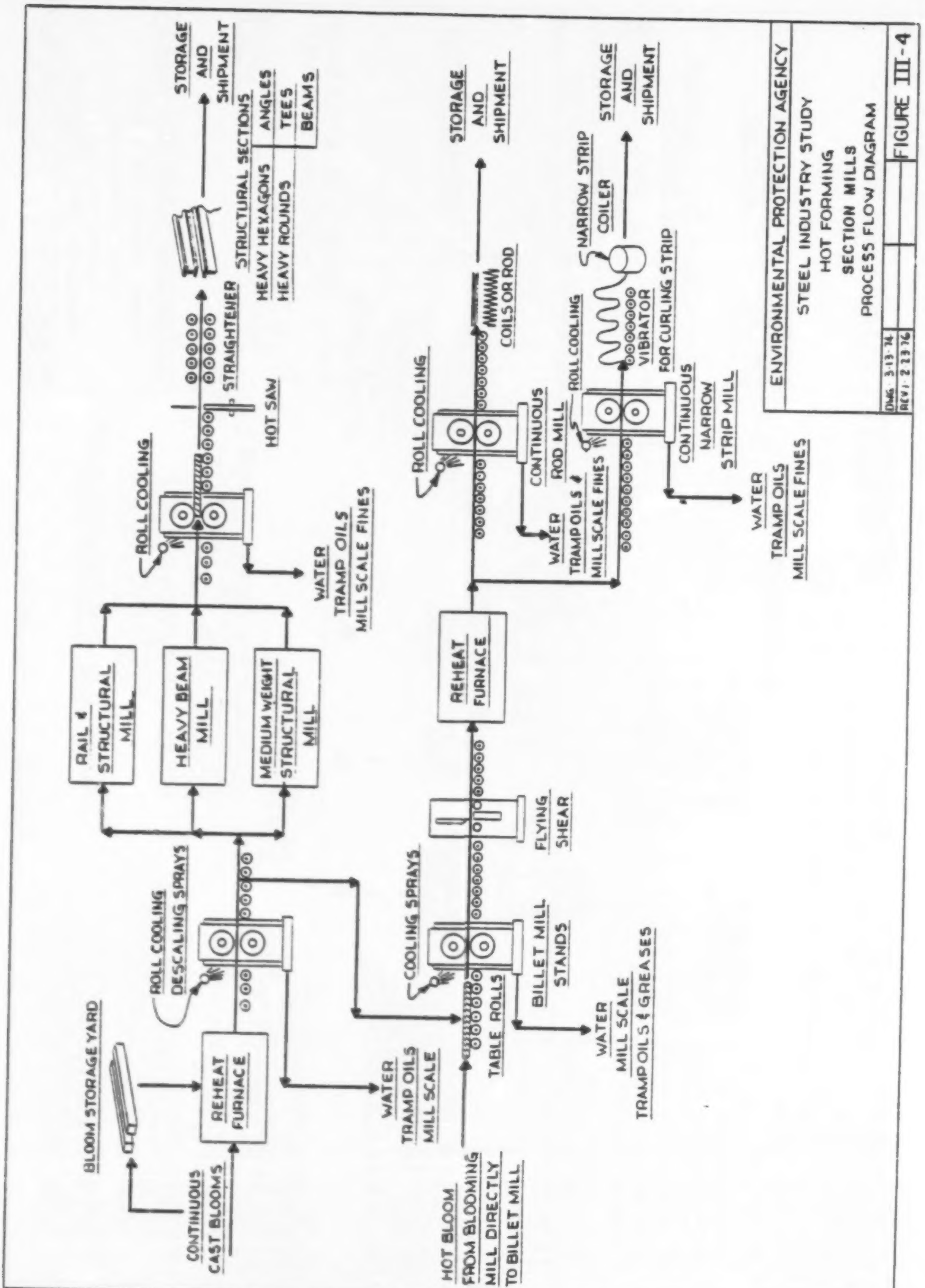
FIGURE III-2


850 to 4,814 cu. m/min
(30,000 to 170,000 cfm) Systems
49°C to 60°C(120°F to 140°F)
Saturated gases with water droplets.
± 0.005 lbs submicron particles
per lb of steel removed in scarfing.
Typical gases:
CO2 - 1.5 %
O2 - 20.3 %
N - 77.6 %
CO - 0.6 %
Total - 100%
Off gas & fume
0.225 lbs./ton
Coolant water
Slag removal water
Compressed purge air
Oxygen
Natural gas
SCARFER HOOD
20,000-100,000 scfm Air inlet
Billet, bloom or slab
1/32" to 3/16" thickness of steel surface removed from blooms or slabs during scarfing.
Oxygen-fuel gas preheating flames raise surface temperatures to melting, pure dry oxygen is then applied to surfaces for removing defects.
Scarfer table rolls control speed of scarfing, 50-250FPM
2% removal in scarfing
MILL SCALE & SLAG
Approximate Composition
Metallic iron(Fe) - 44%
Ferrous oxide(FeO) - 33%
Ferric oxide(Fe2O3) - 21%
Balance(SI O2, Mn, C, S, etc.) - 2%
Total - 100%
4380 l/kkg
(1050 gal/ton of steel scarfing)
4,587 l/kkg
(1,100 gal/ton)
SCALE PIT
Make-up
206 l/kkg
(50 gal/ton)
DEMISTING CHAMBER
Gas
Waste water
Water at 7-12 gal/1000 ft³
Saturated gases
1668 l/kkg
(400 gal/ton)
Recycle Pumps
206 l/kkg
(50 gal/ton)
Blowdown discharge water will be acidic when scarfing resulfurized steels
Exhaust
(30,000 to 170,000 cfm)
Saturated (140°F) 60°C
Fan
Stack
SCARFER SCRUBBER SYSTEM
Exhaust
30,000 to 170,000 CFM
Saturated (140°F) 60°C
WET PRECIPITATOR
Gas
Fan
Stack
WET PRECIPITATOR SYSTEM
21 l/kkg (5 gal/ton) for Intermittant wash
209 l/kkg (50 gal/ton) for Continous wash
Dwn. 8/15/79

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING-PRIMARY MILLS
AUTOMATIC HOT SCARFER
PROCESS FLOW DIAGRAM

FIGURE III-3

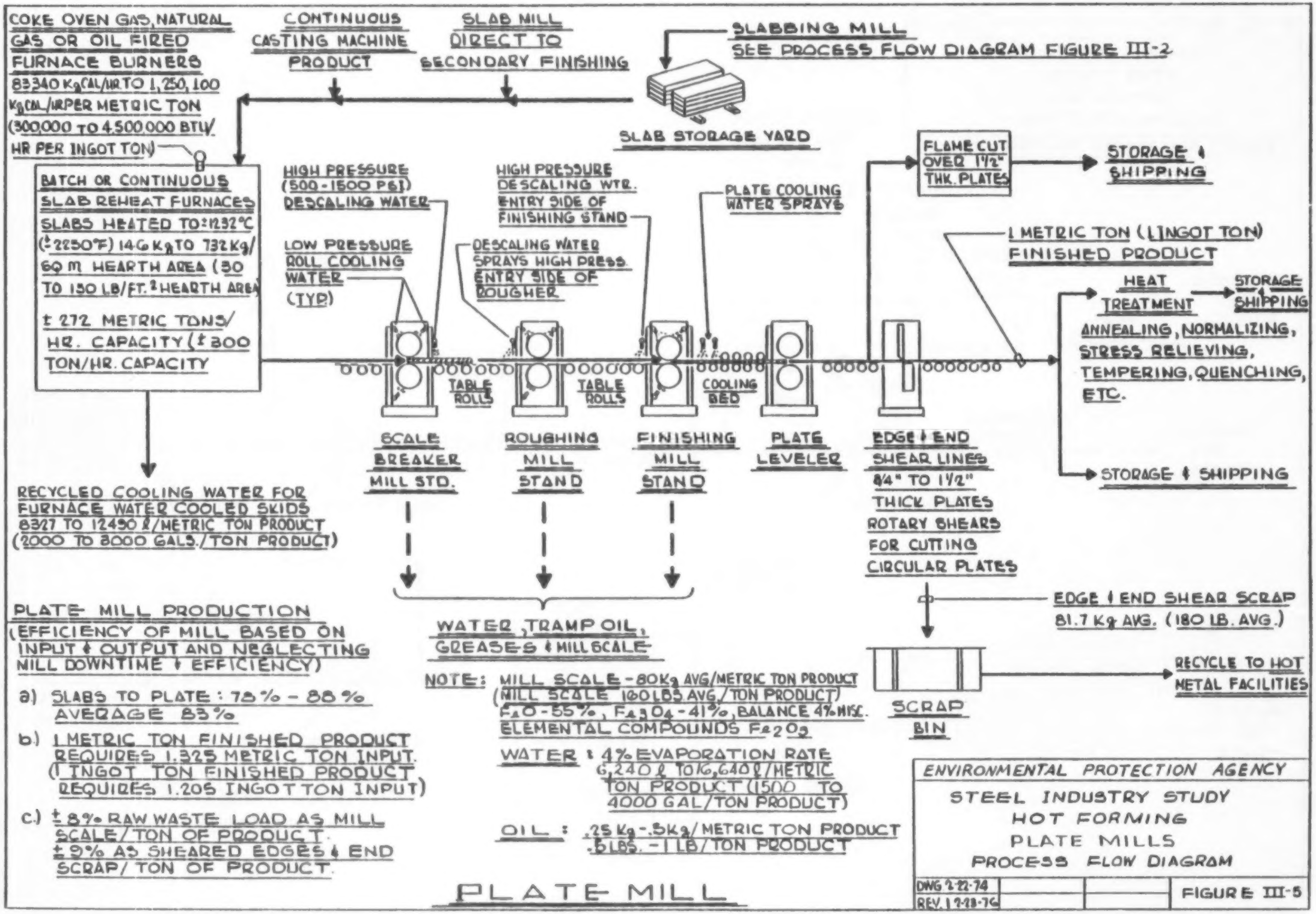

CONTINUOUS CAST BLOOMS
BLOOM STORAGE YARD
REHEAT FURNACE
ROLL COOLING
DESCALING SPRAYS
WATER
TRAMP OILS
MILL SCALE
RAIL & STRUCTURAL MILL
HEAVY BEAM MILL
MEDIUM WEIGHT STRUCTURAL MILL
ROLL COOLING
WATER
TRAMP OILS
MILL SCALE FINES
HOT SAW
STRAIGHTENER
STRUCTURAL SECTIONS
HEAVY HEXAGONS
HEAVY ROUNDS
ANGLES
TEES
BEAMS
STORAGE AND SHIPMENT
HOT BLOOM FROM BLOOMING MILL DIRECTLY TO BILLET MILL
TABLE ROLLS
COOLING SPRAYS
BILLET MILL STANDS
WATER
MILL SCALE
TRAMP OILS & GREASES
FLYING SHEAR
REHEAT FURNACE
ROLL COOLING
CONTINUOUS ROD MILL
WATER
TRAMP OILS &
MILL SCALE FINES
COILS OR ROD
STORAGE AND SHIPMENT
ROLL COOLING
CONTINUOUS NARROW STRIP MILL
WATER
TRAMP OILS
MILL SCALE FINES
VIBRATOR FOR CURLING STRIP
NARROW STRIP COILER
STORAGE AND SHIPMENT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
SECTION MILLS
PROCESS FLOW DIAGRAM

DWG 3-13-74
REV 1-2-23-76

FIGURE III-4


COKE OVEN GAS, NATURAL GAS OR OIL FIRED FURNACE BURNERS 83,340 Kg CAL/HR TO 1,250,100 Kg CAL/HR PER METRIC TON (300,000 TO 4,500,000 BTU/HR PER INGOT TON)
CONTINUOUS CASTING MACHINE PRODUCT
SLAB MILL DIRECT TO SECONDARY FINISHING
SLABBING MILL SEE PROCESS FLOW DIAGRAM FIGURE III-2
SLAB STORAGE YARD
BATCH OR CONTINUOUS SLAB REHEAT FURNACES
SLABS HEATED TO ±1232°C (±2250°F) 146 Kg TO 732 Kg/ SQ M HEARTH AREA (30 TO 150 LB/FT.² HEARTH AREA)
± 272 METRIC TONS/ HR. CAPACITY (± 300 TON/HR. CAPACITY
HIGH PRESSURE (500-1500 PSI) DESCALING WATER
LOW PRESSURE ROLL COOLING WATER (TYP)
DESCALING WATER SPRAYS HIGH PRESS. ENTRY SIDE OF ROUGHER
HIGH PRESSURE DESCALING WTR. ENTRY SIDE OF FINISHING STAND
PLATE COOLING WATER SPRAYS
TABLE ROLLS
TABLE ROLLS
COOLING BED
SCALE BREAKER MILL STD.
ROUGHING MILL STAND
FINISHING MILL STAND
PLATE LEVELER
EDGE & END SHEAR LINES 3/4" TO 1 1/2" THICK PLATES ROTARY SHEARS FOR CUTTING CIRCULAR PLATES
FLAME CUT OVER 1 1/2" THK. PLATES
STORAGE & SHIPPING
1 METRIC TON (1 INGOT TON) FINISHED PRODUCT
HEAT TREATMENT
STORAGE & SHIPPING
ANNEALING, NORMALIZING, STRESS RELIEVING, TEMPERING, QUENCHING, ETC.
STORAGE & SHIPPING
RECYCLED COOLING WATER FOR FURNACE WATER COOLED SKIDS 8327 TO 12490 ℓ/METRIC TON PRODUCT (2000 TO 3000 GALS./TON PRODUCT)
WATER, TRAMP OIL, GREASES & MILL SCALE
EDGE & END SHEAR SCRAP 81.7 Kg AVG. (180 LB. AVG.)
SCRAP BIN
RECYCLE TO HOT METAL FACILITIES

NOTE: MILL SCALE - 80Kg AVG/METRIC TON PRODUCT
(MILL SCALE 160 LBS AVG./TON PRODUCT)
FeO - 55%, Fe_3O_4 - 41%, BALANCE 4% MISC.
ELEMENTAL COMPOUNDS Fe_2O_3

WATER : 4% EVAPORATION RATE
6,240 ℓ TO 16,640 ℓ/METRIC TON PRODUCT (1500 TO 4000 GAL/TON PRODUCT)

OIL : .25 Kg - .5 Kg/METRIC TON PRODUCT
.5 LBS. - 1 LB/TON PRODUCT

PLATE MILL PRODUCTION
(EFFICIENCY OF MILL BASED ON INPUT & OUTPUT AND NEGLECTING MILL DOWNTIME & EFFICIENCY)

a) SLABS TO PLATE : 78% - 88%
AVERAGE 83%

b) 1 METRIC TON FINISHED PRODUCT REQUIRES 1.325 METRIC TON INPUT.
(1 INGOT TON FINISHED PRODUCT REQUIRES 1.205 INGOT TON INPUT)

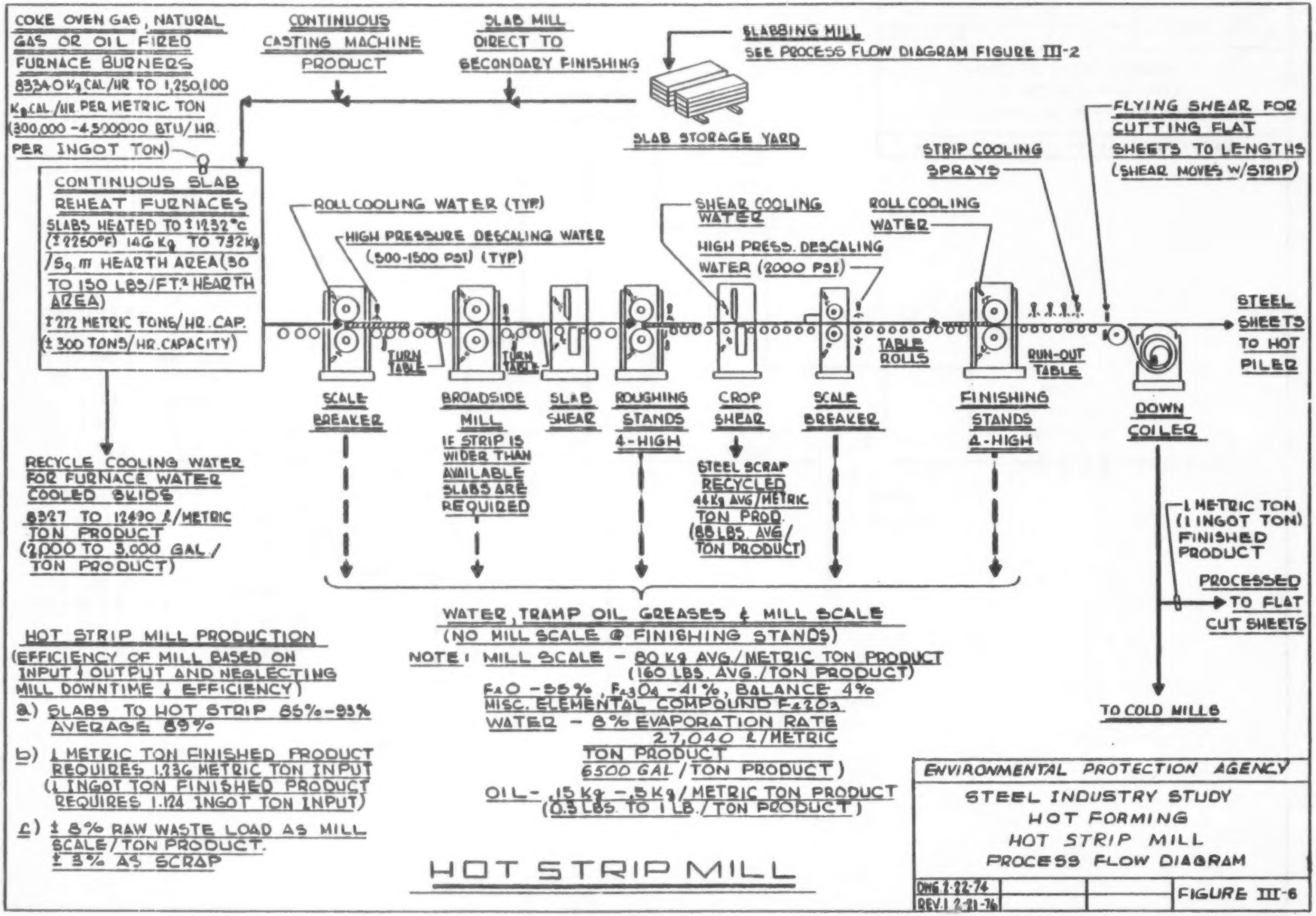
c) ± 8% RAW WASTE LOAD AS MILL SCALE/TON OF PRODUCT.
± 9% AS SHEARED EDGES & END SCRAP/TON OF PRODUCT.

PLATE MILL

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
PLATE MILLS
PROCESS FLOW DIAGRAM

DWG 2-22-74
REV 12-28-76

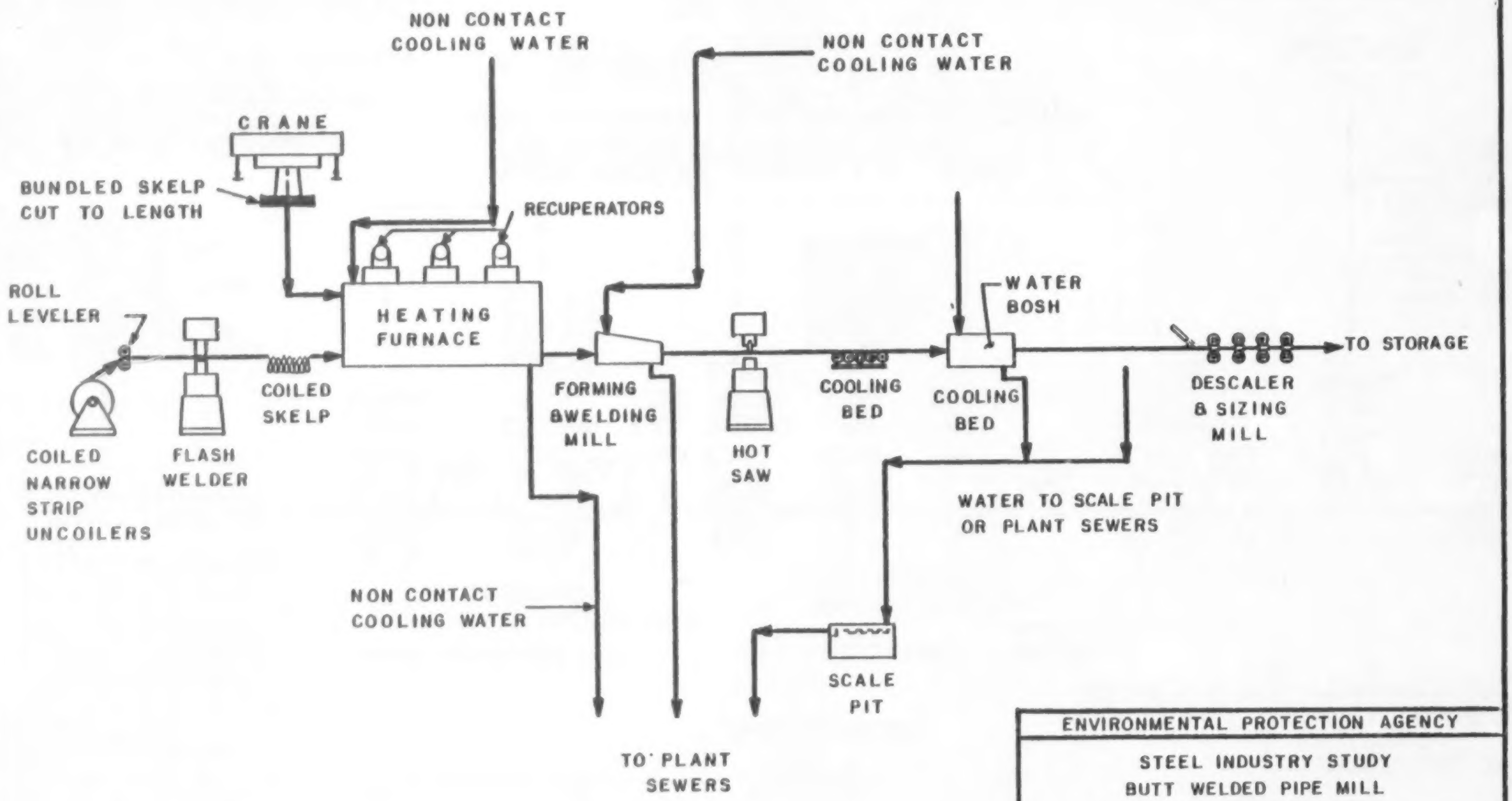
FIGURE III-5


COKE OVEN GAS, NATURAL GAS OR OIL FIRED FURNACE BURNERS
8334-0 Kg CAL/HR TO 1,250,100 Kg CAL./HR PER METRIC TON
(300,000 - 4,500000 BTU/HR. PER INGOT TON)
CONTINUOUS CASTING MACHINE PRODUCT
SLAB MILL DIRECT TO SECONDARY FINISHING
SLABBING MILL
SEE PROCESS FLOW DIAGRAM FIGURE III-2
SLAB STORAGE YARD
CONTINUOUS SLAB REHEAT FURNACES
SLABS HEATED TO ± 1232°C (± 2250°F) 146 Kg TO 732 Kg /Sq m HEARTH AREA (30 TO 150 LBS/FT.² HEARTH AREA)
± 272 METRIC TONS/HR. CAP. (± 300 TONS/HR. CAPACITY)
ROLL COOLING WATER (TYP.)
HIGH PRESSURE DESCALING WATER (500-1500 PSI) (TYP)
SHEAR COOLING WATER
HIGH PRESS. DESCALING WATER (2000 PSI)
ROLL COOLING WATER
STRIP COOLING SPRAYS
FLYING SHEAR FOR CUTTING FLAT SHEETS TO LENGTHS (SHEAR MOVES W/STRIP)
TURN TABLE
TURN TABLE
TABLE ROLLS
RUN-OUT TABLE
SCALE BREAKER
BROADSIDE MILL
IF STRIP IS WIDER THAN AVAILABLE SLABS ARE REQUIRED
SLAB SHEAR
ROUGHING STANDS 4-HIGH
CROP SHEAR
STEEL SCRAP RECYCLED 44 Kg AVG/METRIC TON PROD. (88 LBS. AVG/TON PRODUCT)
SCALE BREAKER
FINISHING STANDS 4-HIGH
DOWN COILER
STEEL SHEETS TO HOT PILER
1 METRIC TON (1 INGOT TON) FINISHED PRODUCT
PROCESSED TO FLAT CUT SHEETS
TO COLD MILLS
RECYCLE COOLING WATER FOR FURNACE WATER COOLED SKIDS
8327 TO 12490 ℓ/METRIC TON PRODUCT (2000 TO 3,000 GAL./TON PRODUCT)
WATER, TRAMP OIL GREASES & MILL SCALE
(NO MILL SCALE @ FINISHING STANDS)
NOTE: MILL SCALE - 80 Kg AVG./METRIC TON PRODUCT (160 LBS. AVG./TON PRODUCT)
FeO - 55%, Fe3O4 - 41%, BALANCE 4% MISC. ELEMENTAL COMPOUND Fe2O3
WATER - 8% EVAPORATION RATE 27,040 ℓ/METRIC TON PRODUCT 6500 GAL/TON PRODUCT)
OIL - .15 Kg - .5 Kg/METRIC TON PRODUCT (0.3 LBS. TO 1 LB./TON PRODUCT)
HOT STRIP MILL PRODUCTION
(EFFICIENCY OF MILL BASED ON INPUT & OUTPUT AND NEGLECTING MILL DOWNTIME & EFFICIENCY)
a) SLABS TO HOT STRIP 85%-93% AVERAGE 89%
b) 1 METRIC TON FINISHED PRODUCT REQUIRES 1.236 METRIC TON INPUT (1 INGOT TON FINISHED PRODUCT REQUIRES 1.124 INGOT TON INPUT)
c) ± 8% RAW WASTE LOAD AS MILL SCALE/TON PRODUCT. ± 3% AS SCRAP
HOT STRIP MILL
DWG 1-22-74
REV. 1 2-21-76

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
HOT STRIP MILL
PROCESS FLOW DIAGRAM

FIGURE III-6

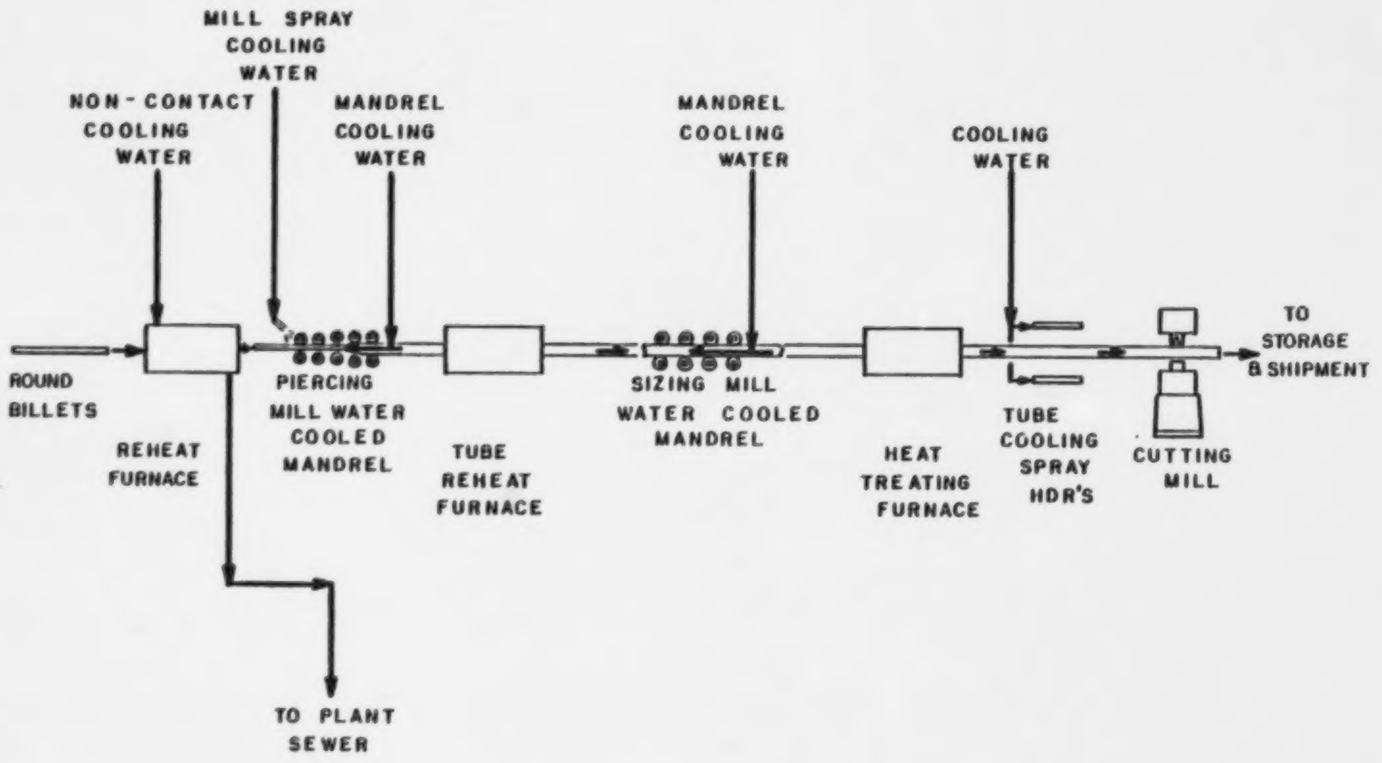

NON CONTACT COOLING WATER
NON CONTACT COOLING WATER
CRANE
BUNDLED SKELP CUT TO LENGTH
RECUPERATORS
ROLL LEVELER
HEATING FURNACE
WATER BOSH
TO STORAGE
COILED SKELP
FORMING &WELDING MILL
COOLING BED
COOLING BED
DESCALER & SIZING MILL
COILED NARROW STRIP UNCOILERS
FLASH WELDER
HOT SAW
WATER TO SCALE PIT OR PLANT SEWERS
NON CONTACT COOLING WATER
SCALE PIT
TO PLANT SEWERS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
BUTT WELDED PIPE MILL
PROCESS FLOW DIAGRAM

Dwn. 3/13/79

FIGURE III-7


MILL SPRAY COOLING WATER
NON-CONTACT COOLING WATER
MANDREL COOLING WATER
MANDREL COOLING WATER
COOLING WATER
ROUND BILLETS
REHEAT FURNACE
PIERCING MILL WATER COOLED MANDREL
TUBE REHEAT FURNACE
SIZING MILL WATER COOLED MANDREL
HEAT TREATING FURNACE
TUBE COOLING SPRAY HDR'S
CUTTING MILL
TO STORAGE & SHIPMENT
TO PLANT SEWER

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
SEAMLESS TUBE MILL
PROCESS FLOW DIAGRAM

Dwn. 3/13/79

FIGURE III-8

HOT FORMING SUBCATEGORY

SECTION IV

SUBCATEGORIZATION

Introduction

The proposed BPT limitations for hot forming operations are the same as those previously promulgated in 1976. However, the Agency developed the proposed BAT, BCT, PSES, PSNS, and NSPS limitations and standards on the expanded data base obtained as a result of this current study.

The division of hot forming into the four subcategories under the originally promulgated limitations has been changed. Hot forming operations have now been combined into one subcategory which has been divided into four major subdivisions which match the old subcategorization scheme. These subdivisions have been segmented further to recognize variations in flow between the different types of hot forming operations. A comparison of the 1976 segmentation with the revised subcategorization is shown below:

Segmentation (1976 Regulation)	Revised Segmentation
Hot Forming-Primary	Hot Forming-Primary
a. Carbon operations w/o scarfers	a. Carbon & Specialty operations w/o scarfers
b. Carbon operations w/scarfers	b. Carbon & Specialty operations w/scarfers
c. Specialty operations	
Hot Forming-Section	Hot Forming-Section
a. Carbon & Specialty operations	a. Carbon operations
	b. Specialty operations
Hot Forming-Flat	Hot Forming-Flat
a. Hot Strip & Sheet operations	a. Hot Strip & Sheet operations
b. Carbon Plate operations	b. Carbon Plate operations
c. Specialty Plate operations	c. Specialty Plate operations
Pipe & Tube (Hot Working)	Pipe & Tube (Hot Working)
a. Carbon & Specialty operations	a. Carbon & Specialty operations

Segments within the four subdivisions are based primarily upon differences in flow rates (applied, process, and discharge).

Although the Agency considered other factors, it found that flow rates and mill configuration were the most important factors in the segmentation of the four basic hot forming subdivisions. The Agency analyzed mill age and size to determine if these factors had a significant effect on either wastewater quality or quantity, or costs, but found no significant relationship. Also, such factors as product type, raw material, wastewater characteristics and treatability were considered. However, the analysis demonstrated that none of these factors are significant in terms of the segmentation developed. Each of these elements is discussed in greater detail below.

Factors Considered in Subcategorization

Manufacturing Process and Equipment

The manufacturing and production processes associated with the forming of a variety of steel products served as the principal basis for defining the hot forming subcategory. As explained in Section III, each hot forming operation is different. The process flow diagrams presented in Section III clearly illustrate these differences which result in different process water usage for the four types of hot forming operations. The Agency found that the different flow rates, more than any other factor, were the most significant in establishing the subdivision contained herein. The flow rates associated with hot forming operations are discussed in greater detail later in this section.

Besides the range of production equipment used at the different types of hot forming operations, the Agency also analyzed the possible variations within each type of operation. For example, there are numerous section operations (i.e., tandem, cross-country). The Agency examined data for these different mill configurations to determine if variations in flow, wastewater characteristics, or other elements existed which would make further subdivision appropriate. However, the Agency determined that the basic subdivision outlined above is affected by differences in equipment only for primary mills, some of which have machine scarfing equipment that generate additional wastewater volumes and pollutants. Hence, an additional effluent limitation allocation is being proposed for those primary mills with machine scarfing equipment.

Final Products

Hot forming operations produce products of widely different size and shape. The revised subcategorization contains four groups which primarily reflect the different products being processed. However, within any one hot forming subdivision, the product type may affect the segmentation of that subdivision. For this reason, the data for each type of hot forming operation were analyzed for variations due to final product considerations. The Agency found that only the flat subdivision required further segmentation because of the type of product processed. There are no product differences that significantly affect the ability to achieve the proposed effluent limitations or standards in the other hot forming subdivisions. Additional details on this factor are presented below.

Primary Mills

In primary operations, two basic final products are processed from the hot steel ingots: slabs and blooms. Most mills (58%) produce either blooms or slabs; however, approximately 35% of the primary mills produce both blooms and slabs. The remaining primary mills (7%) produce products other than slabs or blooms, such as bars or plate.

The data for all primary mills indicate that no significant differences exist among the product types. Water use rates are similar and the Agency found no difference in the technical feasibility of achieving the proposed limitations. For these reasons, the Agency concluded that further subdivision of primary operations based upon product type is not appropriate.

Section Mills

In section hot forming operations, a wide variety of products are produced, ranging from angles to railroad wheels to billets. The responses to the DCPs show that more than 40 different products are produced in the section mills in the United States. At about 30% of the mills, a single product is produced. However, at the remaining mills, more than one product is processed, with some mills producing up to ten products. This great diversity complicated the Agency's analysis of the effect of final products on subcategorization. However, data for the mills producing different products indicate there are no significant variations, thus, no further subdivision was made.

To determine if flow variations exist between the different products, the flow data for the mills were separated into eight product classifications. For example, all types of beam mills were put into the beam category and all the different types of bar mills were classified as bar mills. This grouping of similar product types consolidated the data base and simplified the flow analysis. The Agency then conducted statistical analyses on these groupings to compare the applied and discharge flow rates on a gallon/ton basis. The Agency concluded that the data for all mills are within the same statistical population. The Agency did not find any significant variations which would indicate that any one type of section mill requires more (or less) water or that wastewaters from any one type could not be recycled to the degree necessary to achieve the proposed limitations. For these reasons, the Agency concluded that further segmentation of the section mill subdivision based upon final product considerations was not appropriate.

Flat Mills

The three types of flat mills operating in the United States today are hot strip and sheet mills (HSM), plate mills, and combination mills which produce both plate and hot strip. Of the 80 flat mills, 29 are hot strip mills, 25 are plate mills, and the remaining 26 are combination mills. For this analysis, strip mills, sheet mills, and skelp mills were grouped together under the strip mill designation because of similarities in mill configurations and flow rates.

As with other hot forming operations, different types of flat mills produce similar quality effluents. There were slight differences in the concentrations of the pollutants limited in 1976 (total suspended solids (TSS), oil and grease (O&G), and pH) among the different types of flat mills, but the Agency believes that the differences are not significant enough to warrant further segmentation. More details on wastewater characteristics are provided later in this section.

When the Agency analyzed flow rates for flat operations, it found significant variations which affected the segmentation of the flat subdivision. Hot strip and sheet mills and combination mills were compared, but it was found that both types of mills use similar applied flows and can achieve similar discharge flows. Therefore, combinations mills were combined with hot strip and sheet mills for the purpose of developing effluent limitations. However, the Agency found significant differences between plate and hot strip mills, with hot strip mills using up to 4900 gallons/ton more applied flow than some plate mills. This wide variation led the Agency to further segment the flat subdivision into plate and hot strip mills.

Pipe and Tube Mills

There are two hot working pipe and tube products: butt welded and seamless. The Agency compared data for these pipe and tube mills and found no significant differences between them. Wastewater quality and quantities are similar for both types of mills and the Agency believes the proposed limitations can be achieved at each. Hence, no segmentation of the pipe and tube subdivision is needed.

Raw Materials

Raw materials for hot forming operations include steels of various material specifications. A basic split was made between carbon steel and specialty steel mills. For purposes of this section, any mill rolling less than 50% carbon steel is called a "specialty steel" operation. Of the 485 hot forming operations responding to the DCPs, 96 (19.8%) are specialty steel operations. While the sampling data do not show a significant difference in treated wastewater quality between carbon and specialty operations, the Agency found significant differences in flow rates in some hot forming subdivisions. The differences between the carbon and specialty mills in each hot forming subdivision are examined below.

Primary Mills

Data for primary mills show that raw materials affect only model plant size. There are no significant differences in the wastewater characteristics between the two types of mills. In addition, the Agency found no significant differences in flow between carbon and specialty operations. The average applied flow for carbon mills without scarfers is 2250 gallons/ton, and for specialty mills without scarfers, 2625 gallons/ton. A model applied flow of 2300 gallons/ton was selected for primary operations. The achievability of this model flow is demonstrated by both carbon and specialty operations.

The average production capacity of carbon operations is about 6620 tons/day while that of the specialty operations is about 1440 tons/day. Because of this difference, the Agency prepared separate cost estimates for the carbon and specialty treatment models.

Section Mills

The Agency analyzed carbon and specialty section mills in the same fashion as the primary operations. It found differences in flow rates (5100 gal/ton vs 3200 gal/ton) and model sizes (2920 tons/day vs 1475 tons/day) between carbon and specialty operations which led to further segmentation and separate costing. It did not find any significant differences in wastewater characteristics of the section mills using different raw materials.

Flat Mills

For flat operations, the raw material analysis led to the determination that separate limitations are appropriate for carbon and specialty plate operations due to differences in flow rates (applied and discharge). The Agency found no difference between the carbon and specialty hot strip operations. Also, as for primary and section operations, separate costing was completed for carbon and specialty plate operations.

Carbon plate mills use 1900 gallons/ton more applied flow than the specialty mills (3400 gal/ton vs 1500 gal/ton). For this reason, the Agency is proposing separate limitations for the two types of plate mills.

Flow rates for carbon and specialty hot strip and sheet mills are not significantly different (6380 gal/ton vs 6710 gal/ton). The Agency selected an applied flow basis of 6400 gallons/ton for developing the proposed BAT, BCT, NSPS, PSNS, and PSES limitations and standards for the hot strip and sheet mills. The achievability of this flow rate is well demonstrated by both carbon and specialty operations.

As with the primary and section operations, a difference in the sizes of specialty and carbon plate mills required separate cost development. For the plate mills, the average size of carbon mills is 3480 tons/day and for specialty mills, 1060 tons/day. For hot strip mills, there is no significant difference in size between carbon and specialty operations. In fact, both carbon and specialty products are often rolled on the same mill. For these reasons, all hot strip operations were costed together.

Pipe & Tube Mills

The only significant difference between carbon and specialty pipe and tube operations is in size. Wastewater quality and quantity are similar. Carbon operations have an average applied flow of 5490 gallons/ton and the specialty operations have an average applied flow of 5790 gallons/ton. A flow basis of 5520 gallons/ton is being used to develop the proposed limitations for the carbon and specialty operations. The achievability of the flow is demonstrated by both types of mills.

Production rates are more than twice as great for carbon mills as for specialty mills (970 tons/day versus 480 tons/day). This significant difference in size led to separate costing of the treatment systems.

Wastewater Characteristics and Treatability

The wastewater characteristics of the hot forming operations depend upon scale formation and the oil usage within the mill. Although there are differences in pollutant concentrations generated by different hot forming operations, the Agency concluded that it was not appropriate to subdivide the hot forming subdivisions on this basis as described below.

Suspended solids and oil and grease are the conventional pollutants found in hot forming operation wastewaters. Toxic metal pollutants are also present in lesser concentrations due to the use of alloying agents in the steel. The Agency estimated from scale generation rates that the raw waste concentrations of suspended solids vary from 390 mg/l for specialty plate operations to 7,590 mg/l for carbon primary operations with scarfers. It also estimated from oil usage rates that the oil concentrations in hot forming operation wastewaters range from 15 to 160 mg/l. The Agency estimated the raw waste concentrations for suspended solids and oils because consistent and reliable samples of raw wastewaters were difficult to obtain. At most mills, the Agency sampled the primary scale pit effluent and based its estimates on those data.

As noted above, there is a significant variation in raw wastewater concentrations from hot forming operations. However, these differences are reduced after primary scale pit treatment as shown below:

	Concentration Range of Pollutants(mg/l)	
	Raw Wastewaters	Discharge from Primary Scale Pits
Total Susp. Solids	390-7,590	48-91
Oil & Grease	15-160	15-42

Accordingly, the Agency concluded that it is not necessary to differentiate between the types of hot forming operations because of wastewater characteristics.

Possible variations in wastewater quality between carbon and specialty operations were also analyzed. However, no significant variations were found. While some of the specialty mills did have higher levels of toxic metal pollutants, some carbon mills also had comparably high levels. In any event, toxic metals from both carbon and specialty mills can be reduced to similar levels with the same type of treatment. On this basis, the Agency concluded that no further subcategorization on this basis is warranted.

Similar treatment components are used at all mills and a consistent range of effluent quality is demonstrated. Wastewaters from most mills in each of the hot forming subdivisions are treated in central treatment systems (combining different hot forming wastewaters prior to treatment). Typical treatment components include sedimentation, clarification, or filtration systems, often in combination. Extensive recycle systems are also employed at many plant sites. Flocculation with polymers or other flocculant aid is often used in conjunction with sedimentation. Because of the similarities in treatability of hot forming wastewaters, no further subdivision based upon this factor is appropriate.

Size and Age

The Agency also analyzed possible correlations relating the effects of age and size upon such elements as wastewater flow, wastewater characteristics and the ability to retrofit treatment equipment to existing facilities. However, it found no relationships which warranted further division.

As discussed earlier in this section, size has an impact on costing of the treatment models for specialty and carbon plants. This is the only apparent impact that size has on the hot forming subdivisions. Hot forming operations vary greatly in physical size, layout, and product size. However, an analysis of those factors revealed no significant relationships between process water usage, discharge flow rates, effluent quality, or any other pertinent factor. Figures IV-1 through IV-8 show there are no relationships between discharge flow (gal/ton) and size (tons/day). Since mills are generally operated in a similar manner, the resulting wastewater characteristics are similar regardless of size. The sampling data do not show any significant difference in wastewater characteristics among different sized mills.

The Agency also found that the size of a particular hot forming operation does not affect the ability to install adequate treatment systems. Large and small mills have treatment systems that are approximately the same age and which have similar treatment components. Also, the cost data supplied by the industry show that the costs to install treatment (on a $/ton basis) are more significantly affected by the type of treatment installed. It was found that the costs on a $/ton basis vary slightly based on the size of the mill. However, these variations are accounted for by developing costs for average sized model mill and by developing costs separately for carbon and specialty plants, where necessary.

One additional factor influenced by size is the choice of effluent disposal methods. As noted in most iron and steel subcategories, more of the smaller operations discharge to POTWs than larger mills.. For example, in the hot forming section subdivision (the other hot forming subdivisions show the same trend) the average size of the mills with direct discharges is approximately 1000 tons/day. However, the average size of the mills discharging to POTWs is 580 tons/day. This is because the smaller mills have smaller total wastewater volumes which enable them to discharge more readily to POTW systems. The larger mills, even with good water conservation practices, release larger volumes of wastewater which make it too costly or physically impossible to discharge to POTWs.

The relationship between flow rates and age was analyzed in the same fashion. The plots of discharge flow (gallons/ton) versus age (first year of operation) are shown in Figures IV-9 through IV-16. As with the flow versus size plots, no relationship between flow and age is evident. Therefore, the Agency has concluded that the age of a mill has no significant affect on discharge flow.

The Agency also analyzed the effect of age on the ability, ease, and cost of installing or retrofitting pollution control equipment. Table IV-1 lists older hot forming operations that have been retrofitted with pollution control equipment. The numerous examples illustrate quite effectively that pollution control equipment has been retrofitted on older mills.

The Agency also demonstrated that treatment systems could be retrofitted on older mills at about the same costs as for newer mills. The responses to the D-DCPs and past cost studies were used in this demonstration. Almost all D-DCP responses indicate no retrofit costs were associated with the installation of treatment systems, or, that retrofit costs could not be distinguished from treatment costs. Retrofit costs, typically less than 5% of the total installation cost, were reported for some mills. Retrofit costs were also analyzed by comparing detailed cost estimates completed for retrofitted plants (with no consideration for age) with the actual cost of installation for these systems. This analysis also showed that no significant costs are associated with the installation of treatment facilities onto "older" plants. Hence, the Agency concluded that about the same costs for pollution control are necessary for "older" and "newer" plants.

The sampling data collected during this study were analyzed to determine if age has a significant effect on wastewater characteristics or effluent quality. The ages (first year of production) of the operations sampled varied from 1904 to 1974. No significant differences were noted in effluent quality from older mills versus newer mills. In fact, the mill that was built in 1904 had one of the newest and most sophisticated treatment systems. In any event, comparable levels of discharge were being achieved at mills of all ages where adequate treatment was installed.

Hence, the Agency concluded that age and size do not affect the ability to achieve the proposed effluent limitations.

Geographic Location

The Agency examined the raw waste characteristics, process water application rates, discharge rates, effluent quality and other factors pertaining to plant location and found no general relationship or pattern. Hot forming operations are located in 22 states across the country. Most of these operations are located in the major steel producing areas of Indiana, Illinois, Pennsylvania and Ohio. Table IV-2 summarizes the location of hot forming operations for which DCPs were received.

Approximately 11.5% of the mills are located in what could be considered "arid" or "semi-arid" regions. Because cooling towers are included in BAT, BCT, NSPS, PSES, and PSNS alternative treatment systems, a small amount of water will be consumed as a result of the installation of the model treatment technologies. The Agency analyzed water consumption for hot forming operations and determined the amount to be small. For this reason, subdivision is not necessary because of water consumption or geographic location considerations. Additional details on this issue are presented in Section VIII.

Process Water Usage

As discussed earlier, the Agency found significant variations in both the applied and discharge flows of the various hot forming subdivisions. This factor, in combination with those described previously, led the Agency to revise the segmentation contained herein.

To analyze the flow data, applied flow rates were first developed for each subdivision and each potential segment of that subdivision. Production weighted average flows were used for this analysis. These flow value derivations are shown in Section X for each hot forming subdivision. Statistical analyses were completed on these applied flows to verify previous segmentation and to develop new segments where necessary.

After applied flow rates were developed, the Agency determined recycle rates for each category. These recycle rates were used with the applied flow to calculate the appropriate discharge flows used to develop the proposed BAT, BCT, NSPS, PSES, and PSNS limitations and standards. A summary of the hot forming applied flows, recycle rates and resultant discharge flows is shown below:

Category	Applied Flow (Gal/ton)	Recycle Rates(%) RUP	RTP	Total	Discharge Flow (Gal/ton)
PRIMARY					
a. Carbon & Spec. wo/scarf.	2300	50	46	96	90
b. Carbon & Spec. w/scarf.	3400	50	46	96	140

SECTION					
a. Carbon	5100	50	46	96	200
b. Specialty	3200	50	46	96	130
FLAT					
a. Hot Strip	6400	30	66	96	260
b. Carb.Plate	3400	30	66	96	140
c. Spec.Plate	1500	30	66	96	60
PIPE & TUBE					
a. Carbon & Spec.	5520	50	46	96	220

Additional details on these flow rates and recycle rates are presented in Section X.

TABLE IV-1

EXAMPLES OF PLANTS THAT HAVE DEMONSTRATED THE ABILITY TO RETROFIT POLLUTION CONTROL EQUIPMENT HOT FORMING SUBCATEGORY

Subdivision	Plant Reference Code	Plant Age (year)	Treatment Age (year)
A. Primary	0020B	1948	1971
	0060D	1910	1959
	0060I	1941	1958
	0088D	1959	1971
	0112	1907	1979
	0112A	1930	1970
	0112B	1928	1970
	0176	1917	1965
	0188A	1959	1970
	0188B	1940	1946
	0248C	1962	1975
	0320	1936	1952
B. Section	0060C	1913	1920-1975
	0060F	1942	1965
	0060I	1956	1958
	0060K	1920	1955
	0088D	1962	1971
	0112	1907	1943-1979
	0112A	1937	1971-1978
	0112F	1922	1947-1978
	0136B	1908	1959-1969
	0316	1959	1966
C. Flat 1 - Plate	0112C	1902	1964
	0424	1970	1971-1978
	0448A	1943	1948
	0496	1918	1948-1977
	0860B	1936	1967

TABLE IV-1
EXAMPLES OF PLANTS THAT HAVE
DEMONSTRATED THE ABILITY TO RETROFIT
POLLUTION CONTROL EQUIPMENT
HOT FORMING SUBCATEGORY
PAGE 2

Subdivision	Plant Reference Code	Plant Age (year)	Treatment Age (year)
2 - Hot Strip & Sheet	0020B	1953	1971
	0396D	1960	1970
	0432A	1957	1974
	0476A	1915	1977
	0684F	1937	1969
	0856D	1938	1980
	0856P	1929	1966
D. Pipe & Tube	0060C	1913	1948
	0060F	1950	1971
	0060R	1930	1961
	0432A	1957	1974
	0476A	1930	1977
	0548A	1945	1969
	0728	1929	1952
	0856N	1930	1961
	0856Q	1930	1963
	0916A	1931	1971
	0920C	1934	1970
	0948A	1926	1966

TABLE IV-2

GEOGRAPHIC LOCATION OF HOT FORMING OPERATIONS

State	Primary Mills	Section Mills	Flat Mills	Pipe & Tube Mills	Total	% of Total
Pennsylvania	32	79	27	20	158	32.6
Ohio	17	29	15	14	75	15.5
Illinois	11	30	6	11	58	12.0
Indiana	13	19	10	11	53	10.9
Texas	4	6	4	6	20	4.1
California	5	9	2	1	19	3.9
Alabama	3	9	5	0	17	3.5
New York	4	10	1	0	15	3.1
Maryland	4	5	3	2	14	2.9
Colorado	1	11	0	1	12	2.5
Michigan	4	3	2	0	9	2.0
West Virginia	2	3	1	0	6	1.2
Georgia	0	6	0	0	6	1.2
Kentucky	3	0	1	1	5	1.0
Utah	2	1	1	0	4	0.8
Missouri	0	0	4	0	4	0.8
Washington	1	2	0	0	3	0.6
Florida	0	3	0	0	3	0.6
Oklahoma	0	1	0	0	1	0.2
N. Carolina	0	1	0	0	1	0.2
S. Carolina	0	1	0	0	1	0.2
Connecticut	0	1	0	0	1	0.2
# of States = 22					485	100

FIGURE IV-1

FLOW vs SIZE ANALYSIS

HOT FORMING - PRIMARY (MILLS WITHOUT SCARFERS)

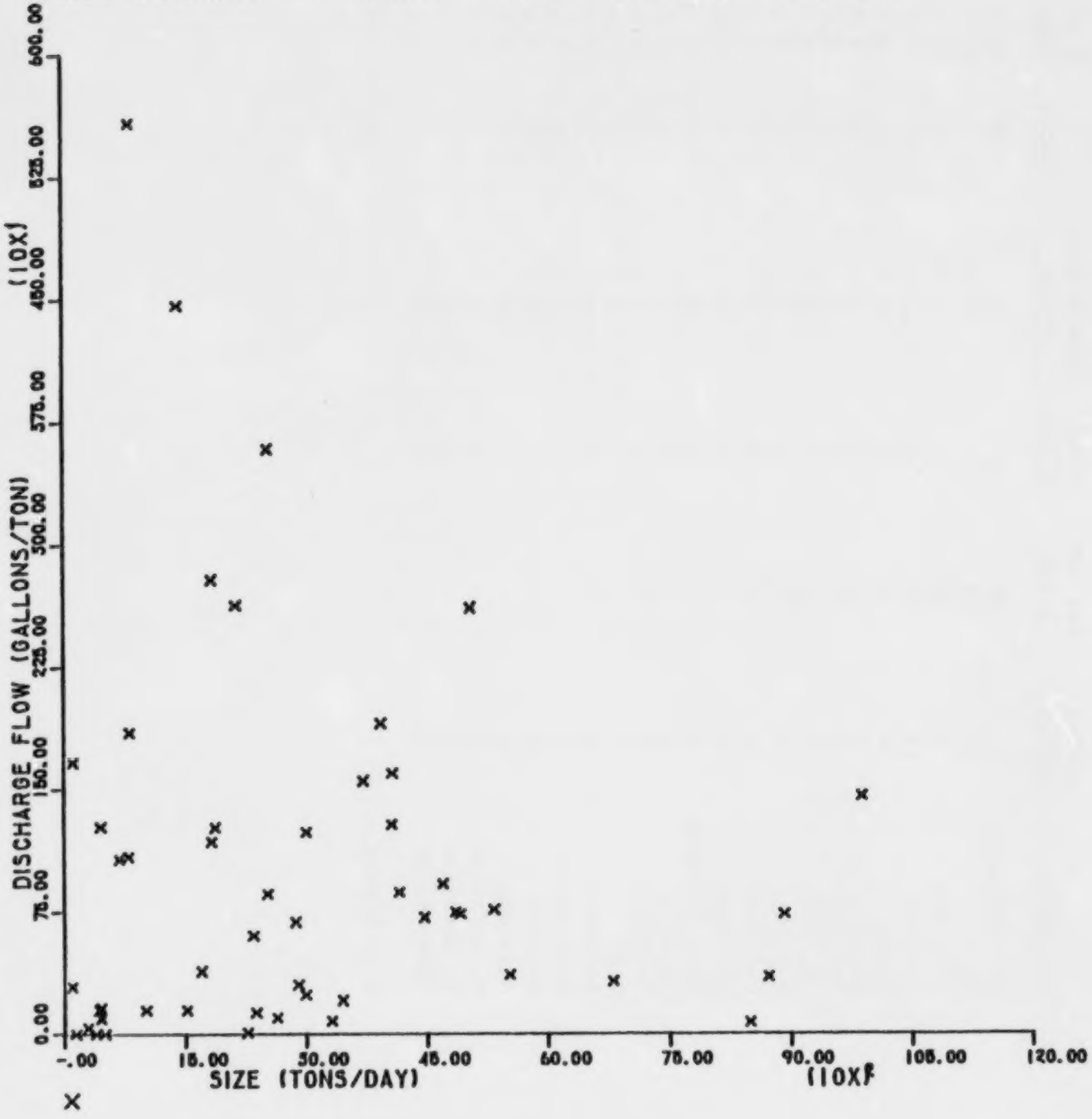


FIGURE IV - 2

FLOW vs SIZE ANALYSIS

HOT FORMING - PRIMARY (MILLS WITH SCARFERS)

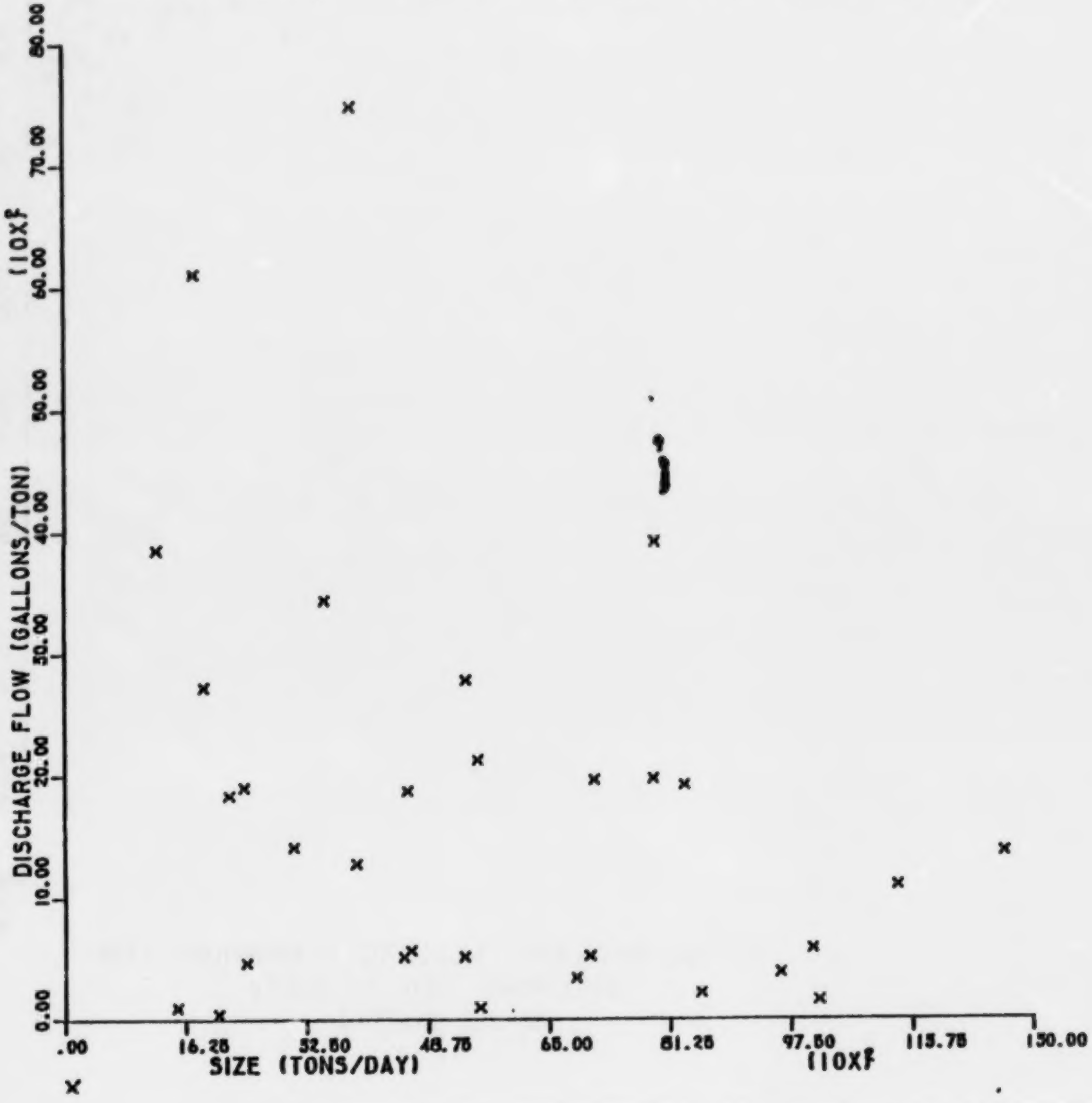


FIGURE IV-3
FLOW vs SIZE ANALYSIS
HOT FORMING - SECTION (CARBON MILLS)

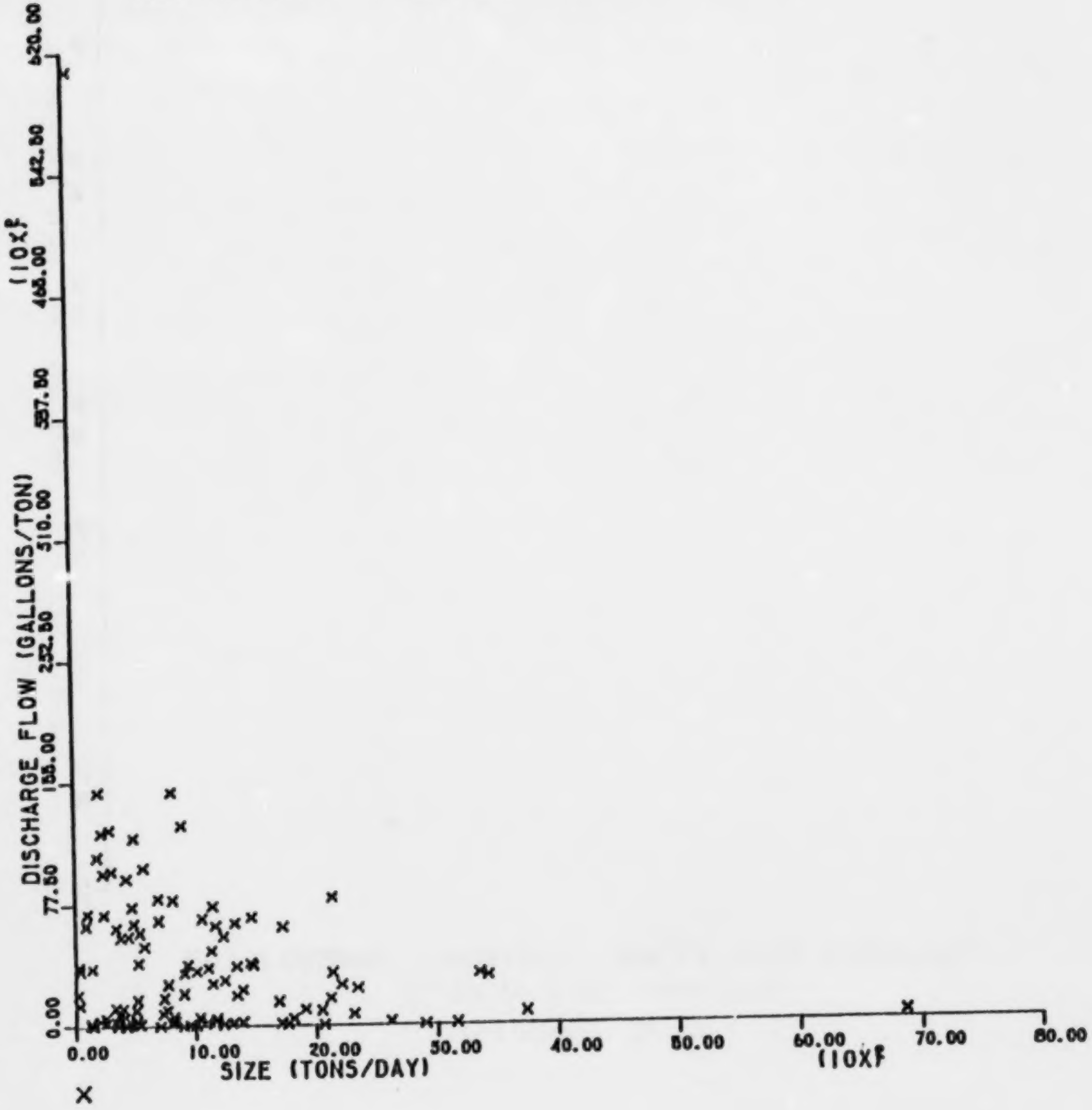


FIGURE IV-4
FLOW vs SIZE ANALYSIS
HOT FORMING - SECTION (SPECIALTY MILLS)

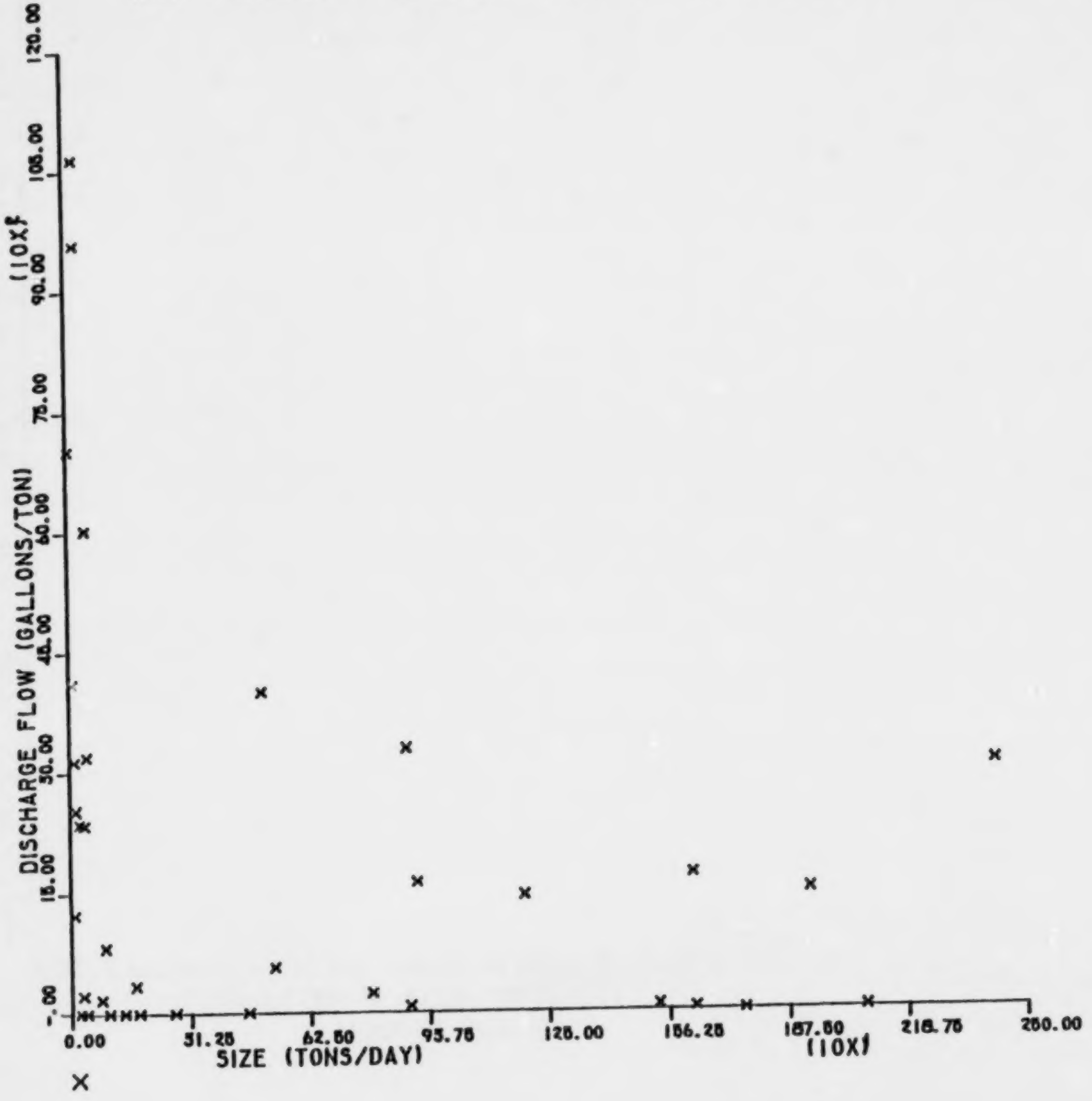


FIGURE IV-5

FLOW vs SIZE ANALYSIS

HOT FORMING - FLAT (HOT STRIP & SHEET MILLS)

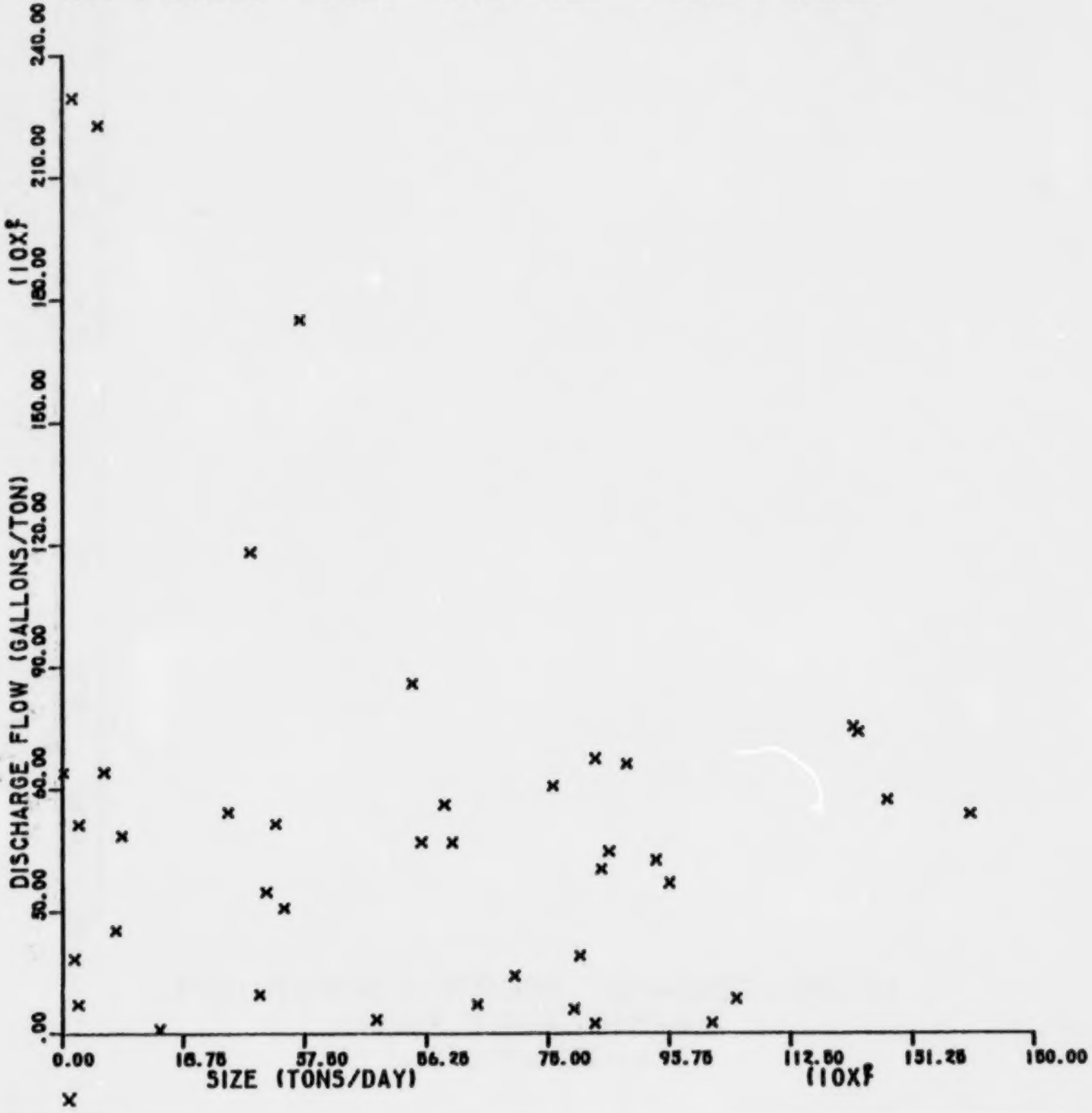


FIGURE IV-6

FLOW vs SIZE ANALYSIS

HOT FORMING - FLAT (CARBON PLATE MILLS)

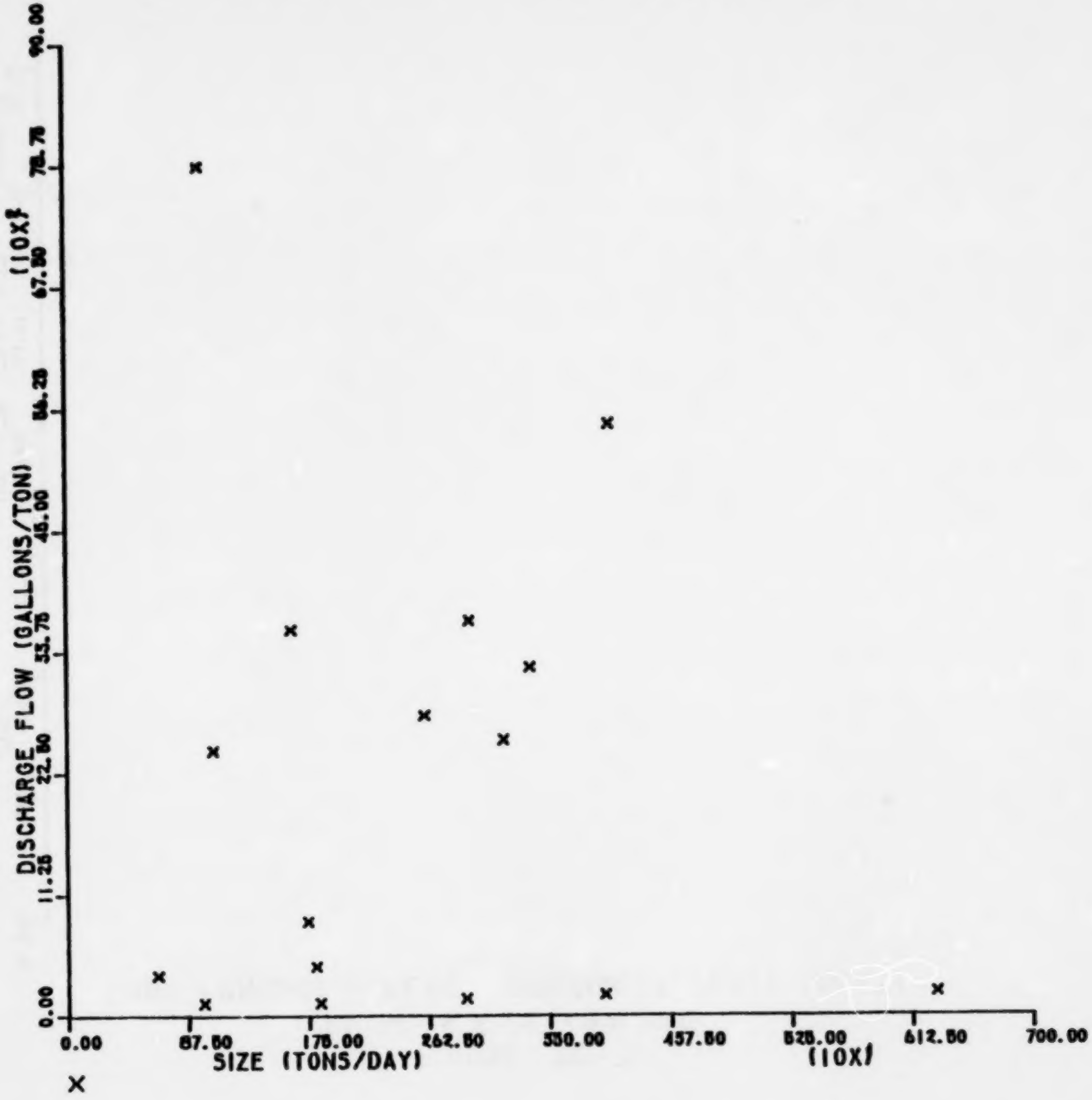


FIGURE IV-7
FLOW vs SIZE ANALYSIS
HOT FORMING - FLAT (SPECIALTY PLATE MILLS)

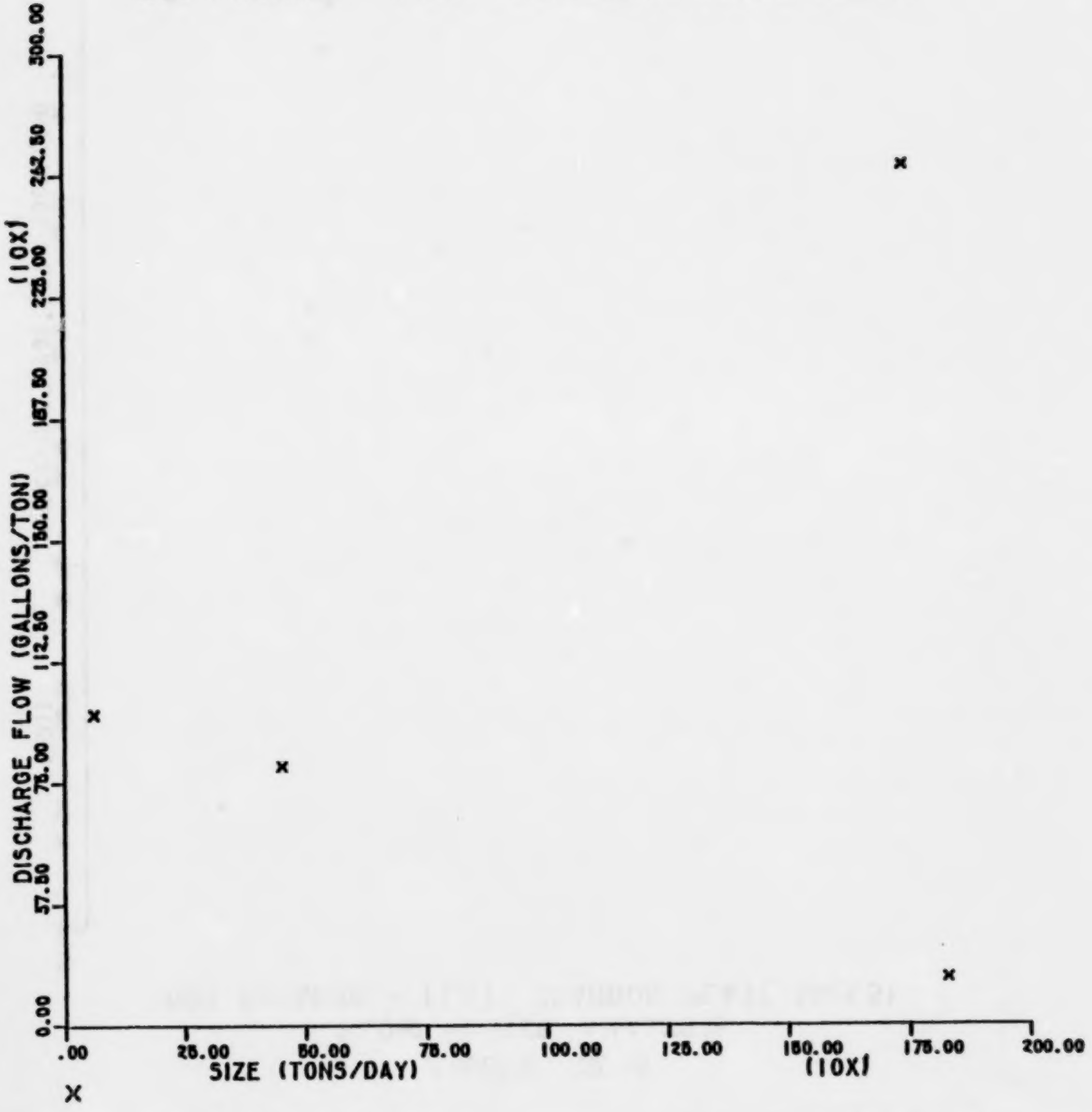


FIGURE IV -8
FLOW vs SIZE ANALYSIS
HOT WORKING PIPE & TUBE

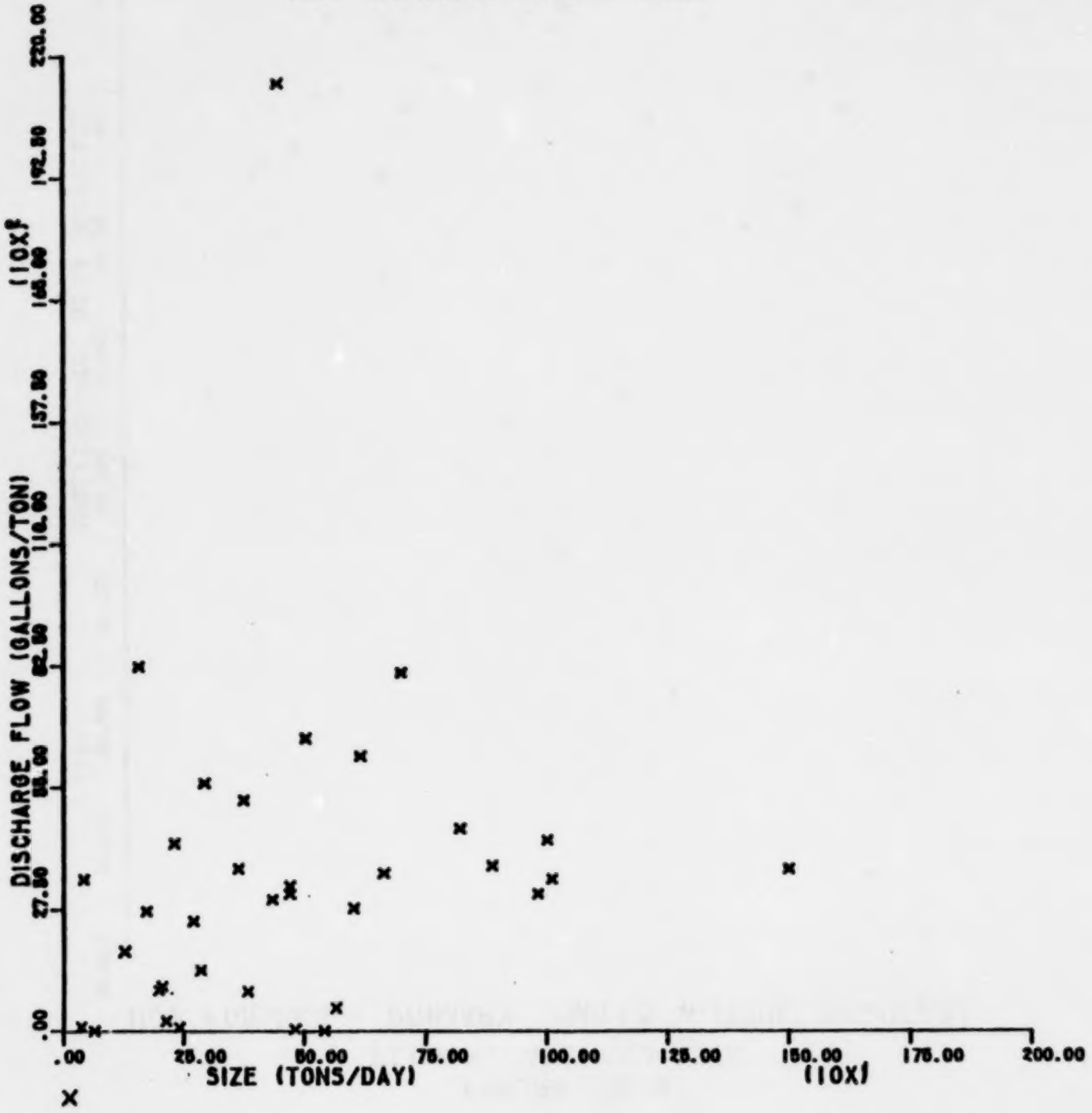


FIGURE IV-9

FLOW vs AGE ANALYSIS

HOT FORMING - PRIMARY (MILLS WITHOUT SCARFERS)

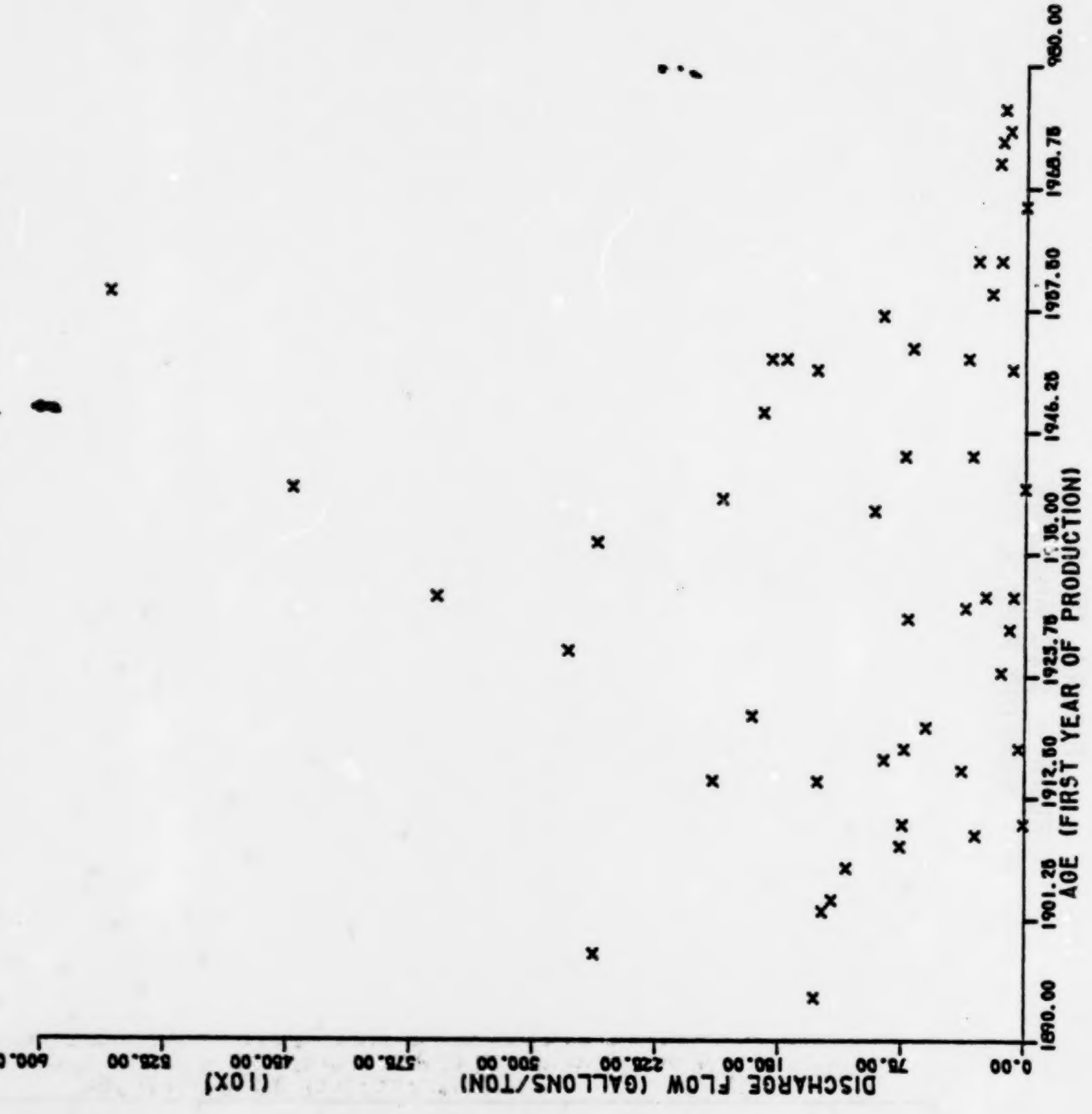


FIGURE IV-10

FLOW vs AGE ANALYSIS

HOT FORMING - PRIMARY (MILLS WITH SCARFERS)

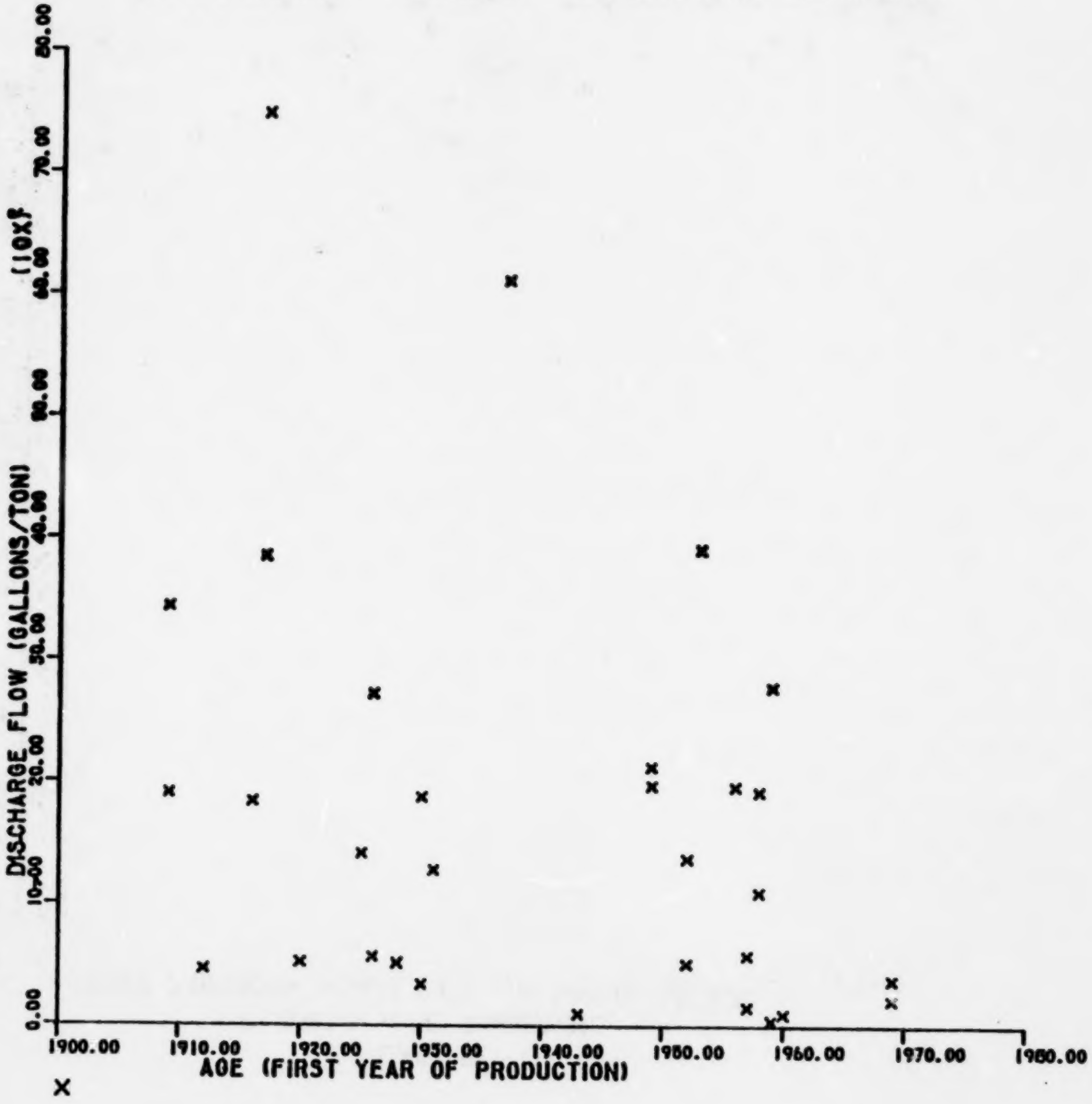


FIGURE IV-11
FLOW vs AGE ANALYSIS
HOT FORMING - SECTION (CARBON MILLS)

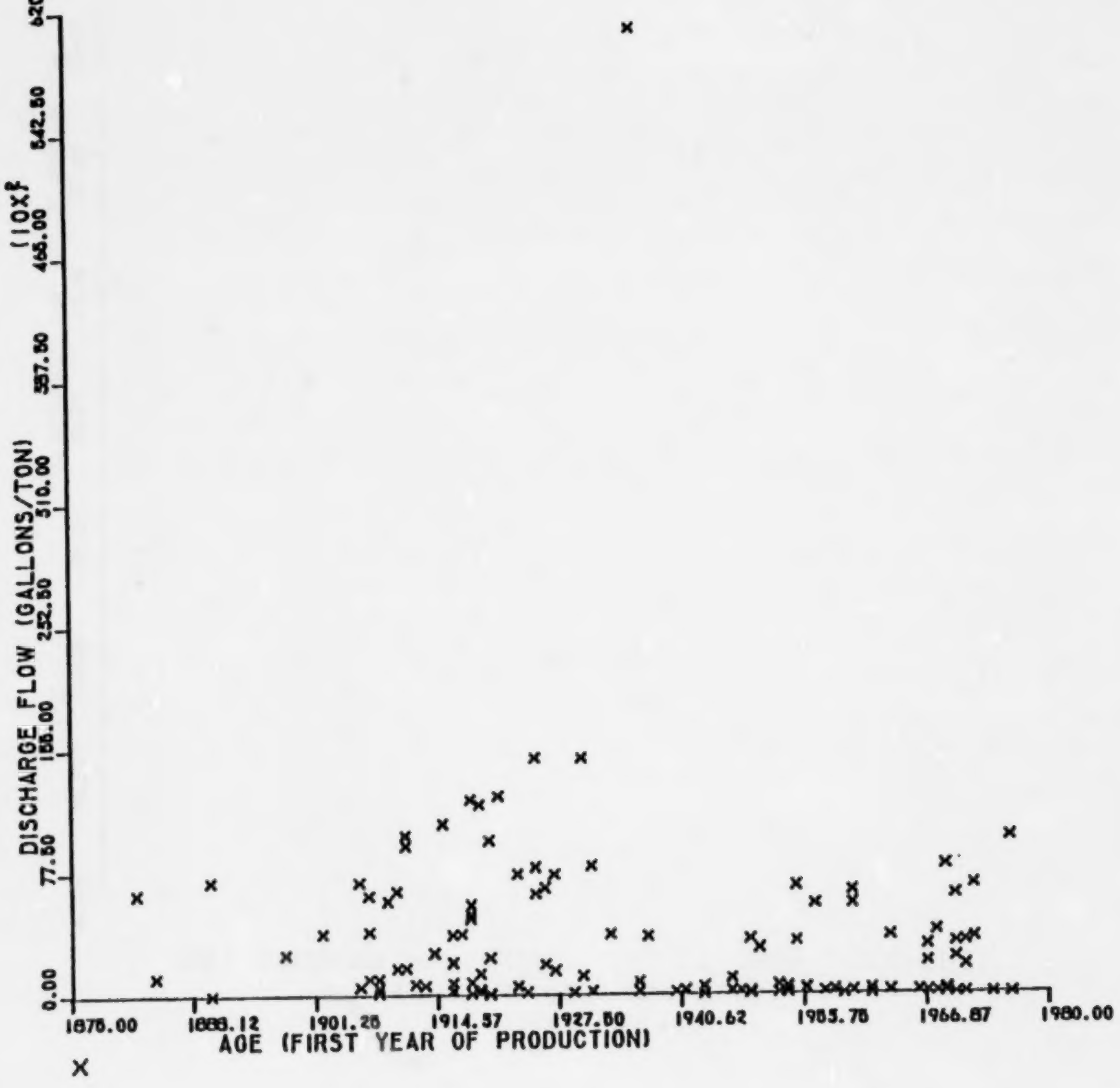


FIGURE IV - 12
FLOW vs AGE ANALYSIS
HOT FORMING - SECTION (SPECIALTY MILLS)

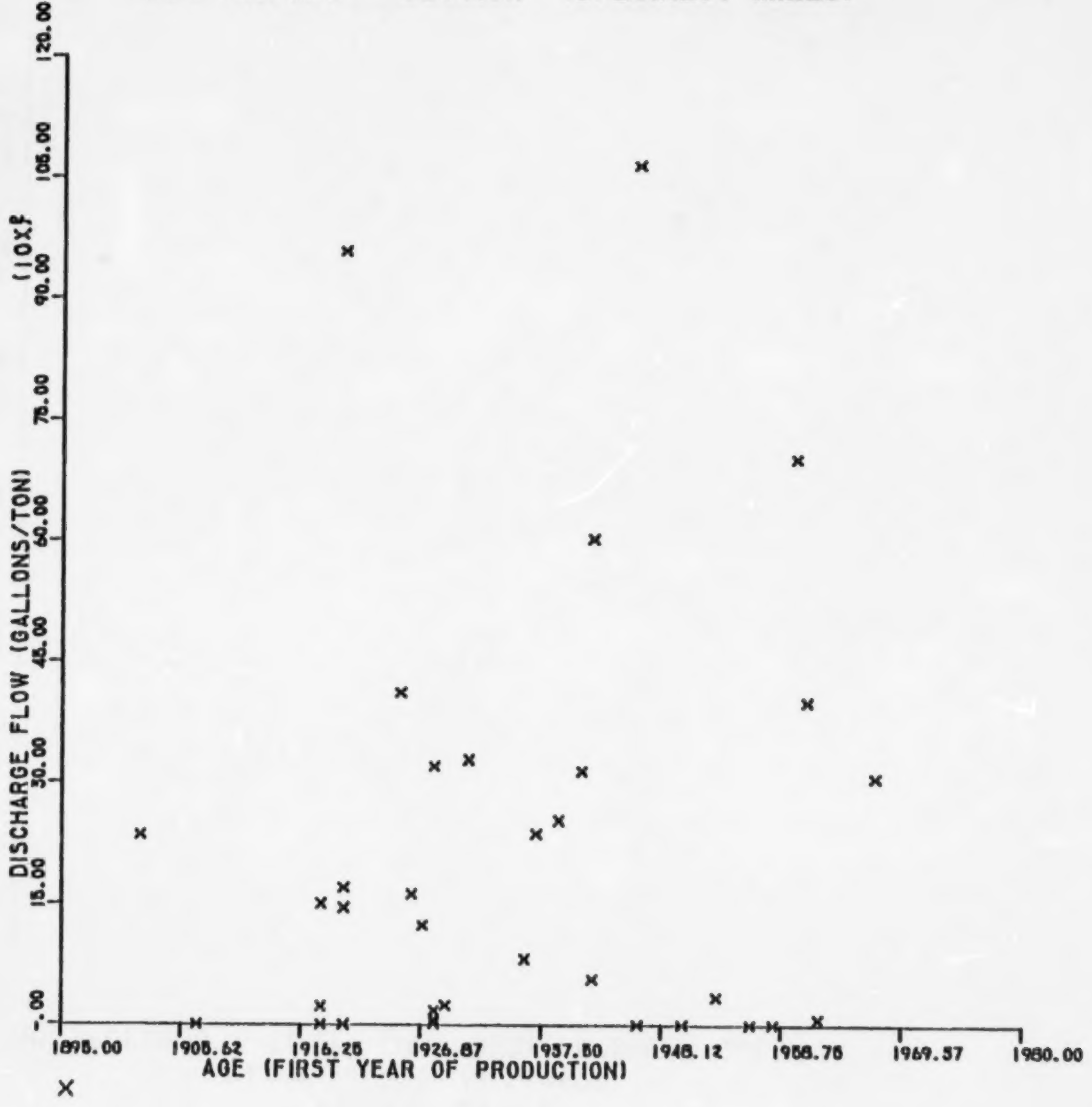


FIGURE IV-13
FLOW vs AGE ANALYSIS
HOT FORMING - FLAT (HOT STRIP & SHEET MILLS)

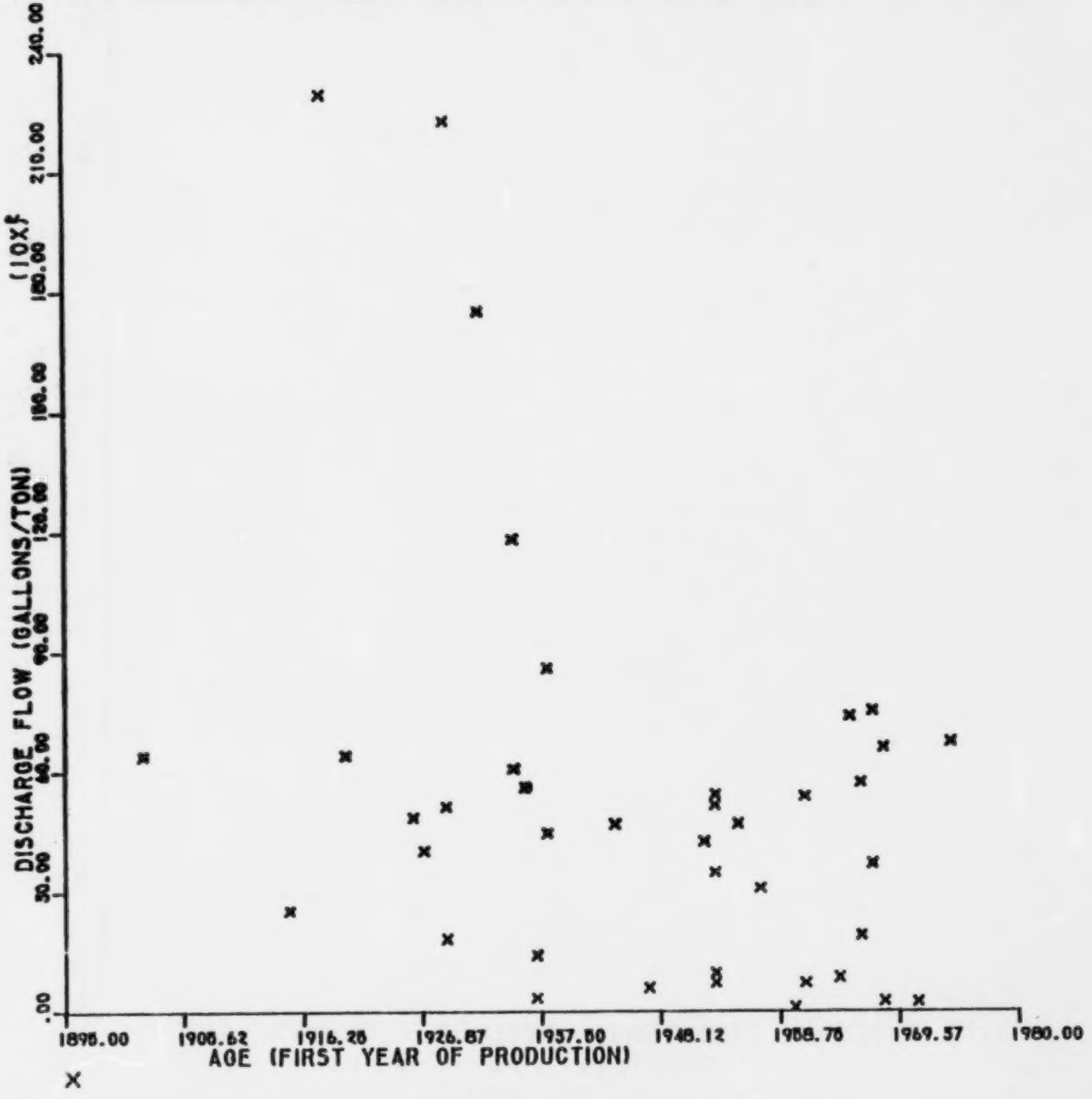


FIGURE IV-14
FLOW vs AGE ANALYSIS
HOT FORMING - FLAT (CARBON PLATE MILLS)

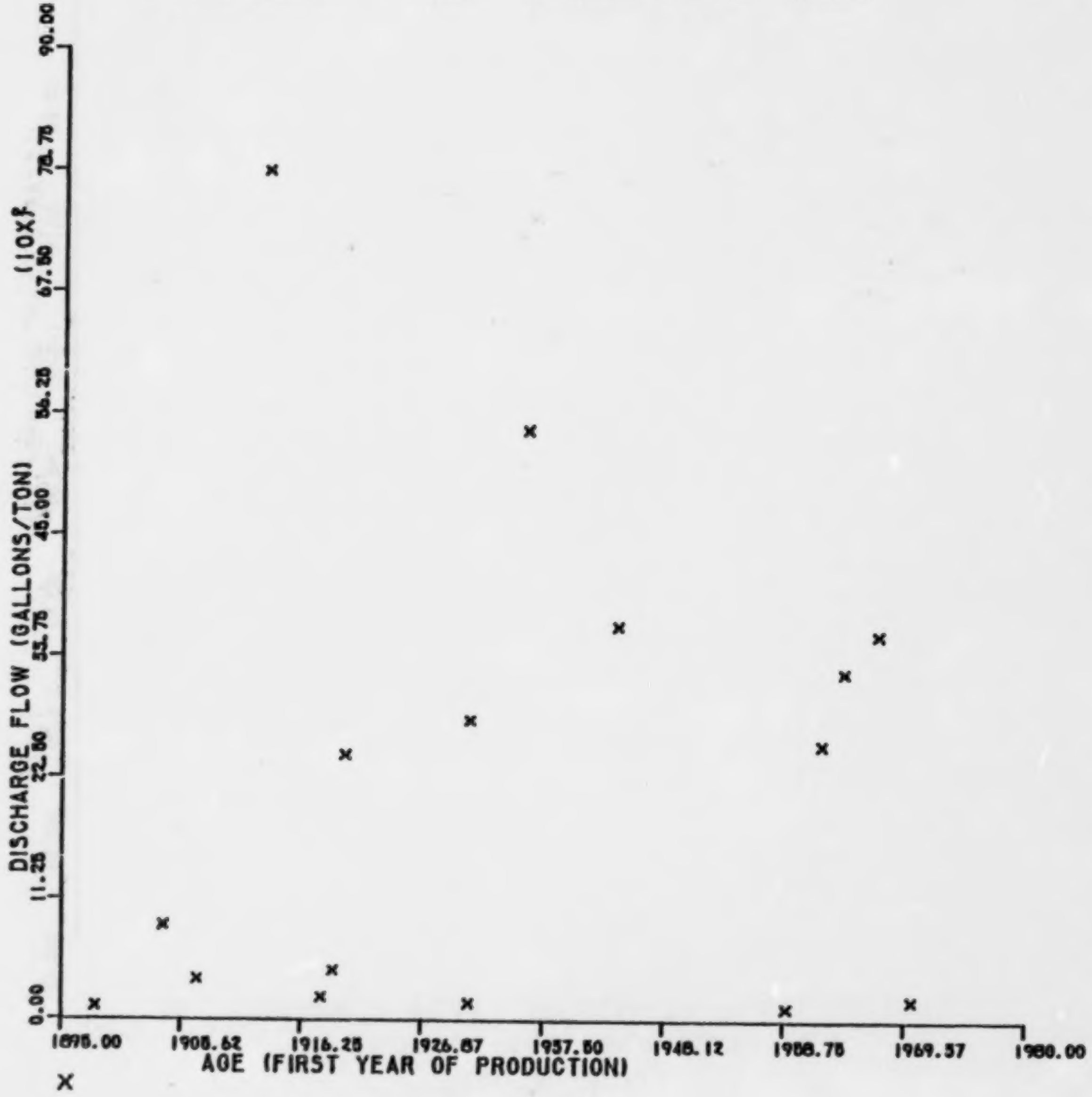


FIGURE IV-15
FLOW vs AGE ANALYSIS
HOT FORMING - FLAT (SPECIALTY PLATE MILLS)

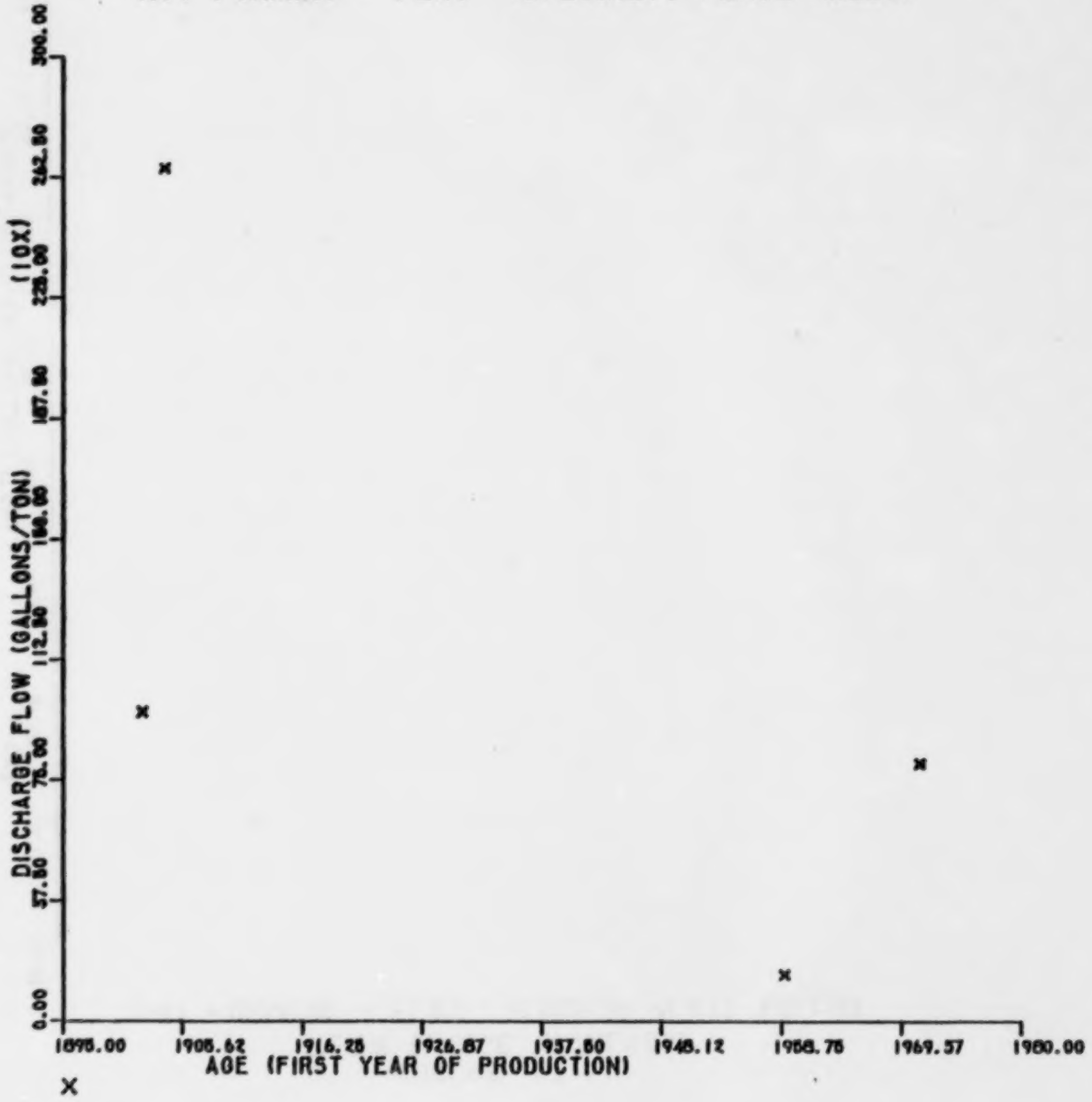
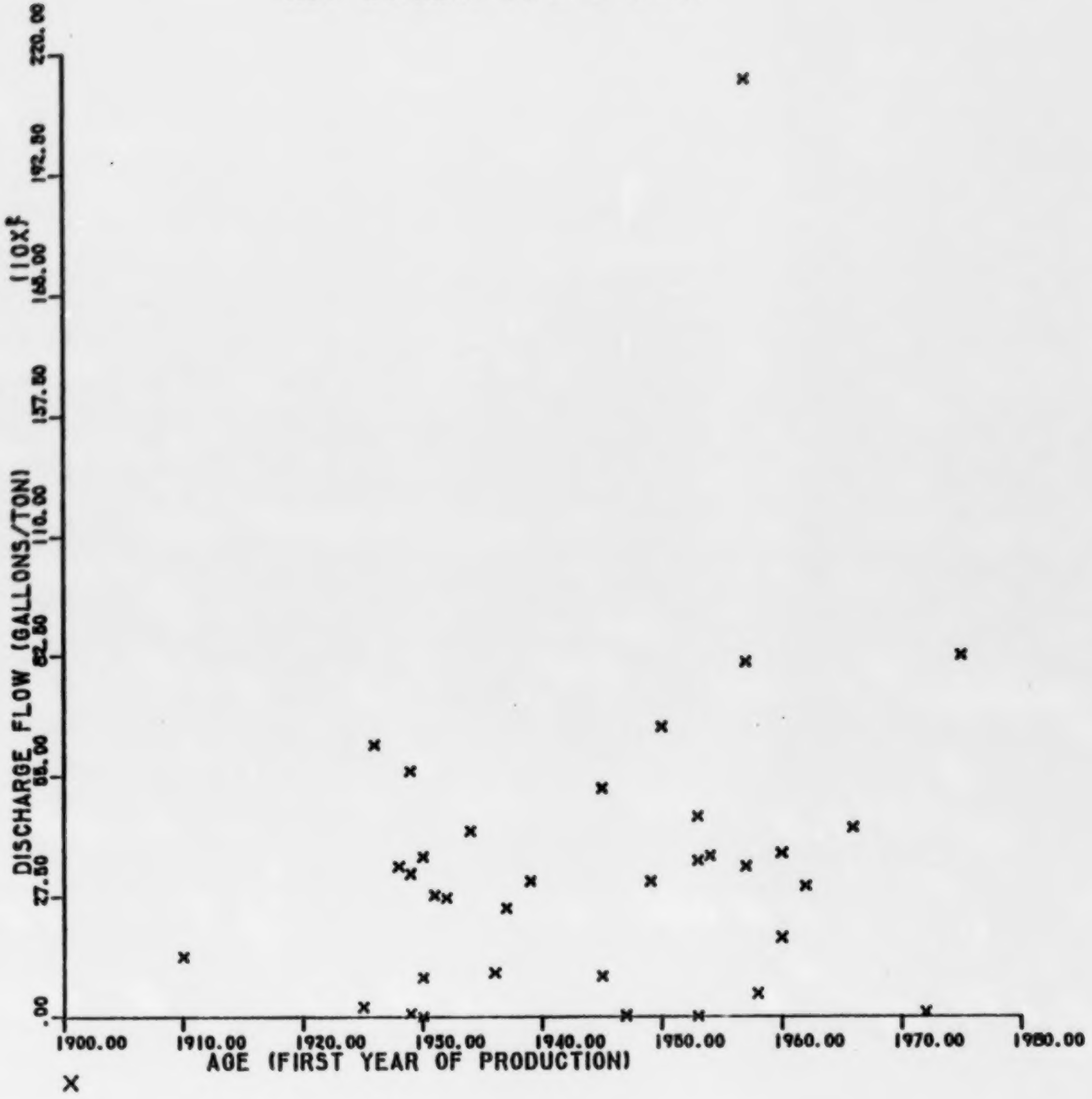


FIGURE IV-16
FLOW vs AGE ANALYSIS
HOT WORKING PIPE & TUBE



HOT FORMING SUBCATEGORY

SECTION V

WATER USE AND WASTE CHARACTERIZATION

Introduction

This section describes the water systems in use in the hot forming subcategory and the types of wastewaters originating from each of the rolling mill processes. The description of the water systems is limited to those water systems which come into contact with pollutants generated by the processes, and excludes noncontact cooling water systems. Waste characterization for hot forming mills is based upon monitoring data obtained during field sampling surveys, data supplied directly by the industry, and upon EPA data.

General Discussion

Water Use

Hot forming wastewaters are comprised of direct contact cooling and descaling waters. Roll cooling water is used to flush the work rolls of the mill stands to prevent surface cracking of the steel rolls due to sudden temperature changes. When not rolling the hot steel, the rolls are kept turning to prevent uneven cooling within the steel rolls. Approximately 4% of the water sprayed on the hot steel evaporates and the balance is discharged beneath the rolling mill to trenches called flumes.

When the hot steel product is being rolled, iron oxide scale (called mill scale) forms on the surface of the hot steel. The scale is removed by direct contact high pressure (1,000-2,000 psig) sprays which release water before each roll pass of the product. Low pressure spray cooling water is also used to keep the mill stand rolls and the table rolls cool as the hot steel passes over or in between them.

Wastewaters from descaling, rolls, hot shear equipment cooling, roll tables, and flume flushing, are generally discharged through flumes or trenches to inground concrete settling chambers called scale pits where the heavier solid particles settle out. Scale pits often contain underflow weirs with launders to trap oils and greases picked up by the process waters. The waste oils are removed from the water surfaces by belts, ropes, or other types of floating oil skimmers, and then discharged to waste oil storage tanks. Contract haulers periodically remove the accumulated oils. The scale is cleaned by clam shell buckets or scale pit drag link conveyors. Waste oils are generated at an average rate of 0.1 to 0.2 gallons per ton of steel produced at each rolling mill operation (i.e., primary, section, etc.). Major sources of oils at many mills are the oil cellars where recirculated oils are conditioned, i.e. separated from entrained water. The discharge from these pits often contains high quantities of oil and is usually directed to the scale pits. Other major sources of oil include leaks from lubricating and hydraulic systems. The scale pit overflows are generally not directly discharged, but are usually routed to wastewater treatment plants for additional treatment. Many rolling mills recycle part of the scale pit effluent back to the rolling mill for use in flume flushing.

Waste Characterization

Scale and oil and grease are the conventional waste products from rolling mill operations. As the hot steel is being rolled in the mill stands, the steel surface oxidizes and is continuously scaling and chipping off. The scale particles range in size from submicron to several millimeters. The particles are 70-75% iron and consist of ferrous oxide (FeO), and ferric oxide (Fe_2O_3). Overhead cranes equipped with clam buckets are generally used to clean the scale pits. Scale pit effluents are discharged to plant sewers or are partially recycled back to the mills. The suspended solids content in scale pit overflows can be as high as 50 to 300 mg/l. These wastewaters can be further treated by means of clarification, filtration, and recycle. Oils from the scale pit effluents are generally in the range of 15 to 45 mg/l. Oils are found in rolling mill wastewaters as a result of oil conditioning, oil spills, line ruptures, and excessive dripping of lubricants. Also, appreciable quantities of spent oils and greases are contributed to the wastewaters when equipment is washed down. Concentrations as high as 150 mg/l may be reached during line ruptures.

The discharges from the different types of hot forming operations are similar with respect to suspended solids, oil and grease, and pH. However, the quantity of solids and applied water rates in gallons per ton vary among rolling mills.

Toxic metal pollutants have been detected in the wastewaters from the rolling mills. The appearance of toxic metals such as chromium, copper, lead, nickel, and zinc result from the use of these metals in steelmaking and alloying and possibly in lubricants used at certain mills. Relatively few toxic organic pollutants were detected in wastewaters from the hot forming mills sampled. This subject is more completely discussed in Section VI.

Specific Discussion

Water Use

1. Primary Rolling Mills

   The blooming or slabbing rolling mills generally have six main contact water systems.

a. High pressure descaling spray water
b. Mill stand roll and roll table spray cooling water
c. Hot shear spray cooling water
d. Flume flushing
e. Hot scarfer spray flushing and cooling system
f. Hot scarfer wet gas cleaning system

The first four sources are common to all hot forming operations and were briefly discussed above. The last two sources - hot scarfer water system and hot scarfer gas scrubber systems are described below.

Automatic Hot Scarfers

The use of automatic hot scarfing machines for surface finishing results in the generation of fumes, smoke, and slag. The scarfing operation results in a continuous production of molten slag ahead of the reaction zone. This slag is directed to a slag pit or trench beneath the scarfer machine and high pressure water is used to break up and flush the slag generated by the scarfing process. Exposed equipment in the vicinity of the scarfing reaction is also sprayed to protect it from heat and flying slag particles. High pressure water (150 psig) is used for flushing the slag from the steel surface while low pressure water (40 psig) is used for the spray cooling water.

Wastewaters from the automatic scarfer spray water systems are generally routed into a scale pit where the heavy slag particles settle out. The scale pit overflow is discharged to plant sewers. Often these spray waters are discharged into the same primary scale pit as the mill equipment cooling and descaling waters.

The high pressure spray water granulates the slag and protects the scarfer pinch rolls from slag splatter. The slag produced weighs approximately 180 lbs/ft^3 dry and 198 lbs/ft^3 wet. The slag particles vary in size from smaller than 100 mesh to less than 1/2 inch in size with most (75%) in the 40 to 60 mesh range. The chemical composition of slag is approximately:

Metallic Iron (Fe)	44%
Ferrous Oxide (FeO)	33%
Ferric Oxide (Fe_2O_3)	21%
Balance (SiO_2, Mn, C, etc.)	2%
	100%

The total iron content in scarfer slag is about 84%.

The quantity of slag produced by the scarfing process ranges from 2% to 4% of the tonnage scarfed whereas the quantity of mill scale produced by the primary mills ranges from 1-1/2 to 3% of the tonnage rolled by the mill.

As noted earlier, the hot scarfing process results in appreciable quantities of fume and smoke. Additional wastewater results when wet type dust collectors are used to clean the exhaust gases from the scarfer. Dry collectors are not normally used because the exhaust gases are saturated. Discharge waters may be acidic if resulphurized steels are being scarfed. The discharge rate varies with the type of gas cleaning system used. The high energy Venturi requires a 1500-2000 gpm water rate. Wet continuous precipitators use about 200 gpm, while intermittent spray wash precipitators use approximately 300 gpm for a 30 second spray every half hour cycle.

2. Section Rolling Mills

Section rolling mills generally have four main mill contact water systems:

a. High pressure descaling spray water
b. Mill stand roll and roll table spray cooling water
c. Hot shear spray cooling water
d. Flume flushing

The combined discharge from these four sources is the wastewater source regulated by the proposed limitations.

3. Flat Mills

a. Plate Mills

Plate rolling mills have three contact water systems:

(1) Descaling water sprays
(2) Mill stand roll and roll table water sprays
(3) Flume flushing

The combined discharge from these three sources is the wastewater source regulated by the proposed limitations.

b. Hot Strip and Sheet Mills

Hot strip rolling mills generally have six mill contact water systems:

(1) Flume flushing water
(2) High pressure descaling water
(3) Low pressure roll coolant water
(4) Table roll and shear cooling waters
(5) Product cooling including runout tables
(6) Coiler cooling water

Large quantities of cooling waters are applied to cool the strip on the runout table after it has been rolled on the final mill finishing stands. This water is relatively clean and is often recycled because of its large volume. Approximately 8% of the strip cooling waters evaporate and the balance is either recycled or further treated with the other wastewaters.

The mill scale from the finishing roll stands is much finer and is retained on a 325 mesh screen. Hot strip and combination mills require greater cooling water rates due to cooling tables and laminar water spray cooling. Laminar flow is a method of non-turbulent water flow over the entire surface of the strip to effect uniform surface cooling and prevent strip distortion.

The combined discharge from the six sources mentioned above is the wastewater source addressed in the proposed limitations.

4. Pipe and Tube (Hot Working)

Wastewaters are generated in the hot working operation as a result of the large amounts of direct contact cooling and descaling waters required by the hot steel and the piercing, plug and reeler mill equipment.

The butt welded pipe mills generally have two types of contact wastewater systems.

a. Roll cooling spray waters
b. Pipe cooling bed water bosh

The pipe cooling bed water bosh is sometimes used to provide adequate cooling capacity without the use of excessively long pipe cooling beds. These wastewaters provide direct contact cooling and are generally discharged to the roll cooling wastewater system.

The seamless tube mills generally use two types of contact water systems:

a. Roll spray coolant waters
b. Spray water quench

The spray quench water system is used to produce higher strength pipe and tube than that achievable by only hot working the pipe and tube. The product is quenched, reheated, and quenched again by means of water sprays. These wastewaters are handled in a manner similar to that of the roll cooling wastewaters.

Recycle Water Rates

To reduce the large volumes of wastewater discharged from hot forming operations, recycle systems are installed at most mills. These systems recirculate either treated or partially treated process water back to the mill which reduces service (makeup) water requirements and discharge flow.

The degree of recycle that can be practiced at hot forming operations is controlled primarily by product quality and temperature requirements of the process water. The water must be fairly cool because one of the principal uses of process water is to cool the rolling stands. Recirculation of hot forming wastes is considered recycled, if the water is recirculated to a hot forming operation. If the water is recirculated to a process other than hot forming, (i.e., BOF, Blast Furnace) it is considered to be reused and is eventually counted as part of the discharge flow from the hot forming mill.

Based on these determinations, the Agency analyzed the recycle rates in hot forming operations. Recycle of scale pit process water and recycle of treated process water were considered separately. A detailed listing of recycle percentages is given in Section X; however, a summary of these data is provided below.

	Average Recycle Rate of Scale Pit Process Water*(%)	Average Overall Process Water Recycle Rate**(%)
Primary Operations	53.3	74.4
Section Operations	53.7	84.6
Flat Operations	29.5	71.2
Pipe and Tube Operations	77.0	73.5

* Average recycle rate of water from primary scale pits for flume flushing or similar process uses, for mills with recycle systems.

** Overall recycle equals the total recycle practiced at mills with recycle systems. As noted above, many mills have higher recycle rates.

Overall process water recycle rates for the better treatment systems exceed 96% for each hot forming subdivision. Several mills have, in fact, reported achieving no discharge.

Wastewater Characteristics

Tables V-1 through V-10 summarize the raw waste concentrations discharged from the hot forming operations sampled for this study. Data are divided into those obtained during the original guidelines study and those obtained during the toxic pollutant study because of the diverse nature of the sampling conducted during the two studies. For the original study, only metals and limited pollutants were analyzed. However, for the toxic pollutant study, toxic metals and toxic organic pollutants were studied in addition to the previously limited pollutants.

Wastewater quality presented in Tables V-1 to V-10 represent the contribution of hot forming operations to the wastewaters. Concentrations were calculated by subtracting all "background" amounts of each pollutant from the individual total pollutant amounts present in the wastewaters. This includes pollutants in the intake water and also pollutants in recycle loops, if any recycle was practiced. Only those pollutants present in the raw wastewaters at levels equal to or greater than 0.010 mg/l are included in the raw waste concentration list. Those data indicate that toxic metals are found in wastewaters from both carbon and specialty operations. Toxic organic compounds were also detected at both types of mills. Table V-11 summarizes the raw waste concentration data for hot forming operations. With the high rate recycle systems considered at the BAT, BCT, NSPS, PSES, and PSNS levels, the impact of small volumes of makeup water on treated effluent quality is not significant. Hence, the proposed effluent limitations were developed on a gross basis.

TABLE V-1

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES SURVEY
HOT FORMING-PRIMARY

Net Concentration of Pollutants in Raw Wastewaters(1)

Reference Code:	0112B-01,02	0112B-03	0684H	0946A	0060	0248B	0020B	0248A	0256K	0432J	0684D	0240A	
Plant Code :	A-2	B-2	C-2	D-2	L-2(2)	D	E	H	K	M	Q	R	
Sample Points :	4-(3+1)(2)	3-3p	1-3	(1+2)-(6+7)	1-2m	9-1	6-10	9-14	12-7	-	4-11(2)	6-1	Average
Flow (gal/ton):	890(3)	510(3)	780(3)	700(3)	610(3)	535(3)	2740	2480(3)	5600	4350	3420	4780	2280
Suspended Solids	78	56	21	37	15	78	80	127	Data	No	47	74	61
Oil & Grease	12	150	1.5	14.2	8	49	26	1.0			10.8	2.4	27
pH (Units)	7.6	8.0-8.3	7.9-8.1	7.8-8.2	7.6-8.1	2.5-6.4	7.0-7.2	6.3	Not	Separate	7.2-7.6	7.4-7.6	2.5 to 8.3
Chromium	NA	NA	NA	NA	NA	NA	-	*	Available	Sample	*	*	*
Copper	NA	NA	NA	NA	NA	NA	*	0.02			*	0.01	0.01
Lead	NA	NA	NA	NA	NA	NA	0.03	0.03		of	0.03	0.03	0.03
Mercury	-	0.0003	0	0.0010	0	NA	NA	NA			NA	NA	*
Nickel	NA	NA	NA	NA	NA	NA	0.18	*		Primary	0.06	0.07	0.08
Zinc	NA	NA	NA	NA	NA	NA	-	*			0.04	0	0.01

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(1) All values are in mg/l unless otherwise noted.
(2) Sample includes wastewater from hot forming operations other than primary.
(3) Includes flow from machine scarfing operation.

* : Net concentration is less than 0.010 mg/l
- : Calculation yielded negative result
0 : Zero value (included in average)
NA : Not Analyzed

NOTE: Negative values (-) are counted as zero in calculating averages.

TABLE V-2

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT SURVEY
HOT FORMING-PRIMARY

Net Concentration of Pollutants in Raw Wastewaters(1)

Reference Code:	0496	0496	0860H	0684H	0176		
Plant Code :	082-140"	082-140"/206"	083	088	081		Overall(2)
Sample Points :	(G_1+H_1)-A	(J_2+H_2)-A	E-(A+B)	(B+C)-(Q)	B-D	Average	Average
Flow (gal/ton):	170(3)	460(3)	320	1700(3)	760	680	1810
Suspended Solids	81	52	235	20	15	81	68
Oil & Grease	63	4	25	0.5	157	50	35
pH (Units)	7.7-7.9	2.6-8.9	7.0-7.1	7.9	7.9-8.1	2.6-8.9	2.5 to 8.9
Cadmium	*	*	*	*	*	*	*
Chromium	0.02	0.02	-	0.04	0.09	0.03	0.02
Copper	0.15	0.26	0.49	0.21	0.44	0.31	0.18
Cyanide	-	-	-	0.002	0.002	*	*
Lead	0.35	0.05	0.06	0.25	0.68	0.28	0.18
Nickel	0.53	0.18	0.09	0.11	0.21	0.22	0.16
Silver	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Zinc	0.04	0.06	0.032	0.02	0.05	0.04	0.032
Chloroform	*	*	-	0.013	*	*	*
Methylene Chloride	0.002	0.002	-	-	-	0.020	0.020
Bis-(2-ethyl hexyl) phthalate	0.149	0.018	-	-	0.003	0.071	0.071
Di-n-butyl phthalate	-	0.002	-	0.01	-	*	*
Di-n-octyl phthalate	-	0.007	-	0.007	0.005	*	*
Tetrachloroethylene	0	0.1	0.27	-	0.005	0.063	0.063

---

(1) All values are in mg/l unless otherwise noted.
(2) Average of all values from Table V-1 and V-2.
(3) Includes flow from machine scarfing operation.

- : Calculation yielded negative result
* : Net concentration is less than 0.010 mg/l
0 : Zero value (included in averages)

NOTE: Negative values (-) are counted as zero in calculating averages.

TABLE V-3

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING-SECTION
NET CONCENTRATION OF POLLUTANTS IN RAW WASTEWATERS[1]

Reference Code:	0240A	0176	0684D	0432J	0424	0284A&B	0256	0176	0112B	0291C	0196A	0384A	0640A	0432A	08560	
Plant Code :	R	O	Q	M	C	H	K	O	A-2	D-2	E-2	F-2*	G-2	H-2	I-2	
Sample Points :	(4-1)	(10-11)	(8-10)	(6-9)	(8-5)	(13-14)	(10-7)	(1-2)	(4-3)	(4+5)-(6+7)	(3+2)-(4+6)	(2-3)	1-(2+4)	(3-1)	(2-6)	Average
Flow (gal/ton):	7960	12,860	1780	670	5260	4210	1470	4970	600	5750	6700	1910	14,020	6950	5010	5341
Suspended Solids	25	78.8	30	53.6	36.8	44	63	-	86.3	30.6	55.3	12.7	22.2	33	124	46.3
Oil & Grease	3.3	-	1.2	9.7	1.0	7.8	3.5	3.4	13.9	13.9	6.4	-	0.5	13.8	1.4	6.3
pH (Units)	7.1	7.5	7.5	6.5	5.1	6.2	7.2	8.4	7.6	8.0	8.3	7.7	7.7	6.6	7.6	5.1 to 8.4
Chromium	0.0	0.01	-	0.06	0.0	0.0	0.0	-	NA	NA	NA	NA	NA	NA	NA	0.0088
Copper	0.0	0.0	0.01	0.0	0.0	0.0	0.4	-	NA	NA	NA	NA	NA	NA	NA	0.0063
Nickel	0.05	-	0.0	0.10	0.11	0.0	-	0.0	NA	NA	NA	NA	NA	NA	NA	0.032
Zinc	0.0	0.0	0.04	-	0.011	0.0	-	0.0	NA	NA	NA	NA	NA	NA	NA	0.0064

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(1) All values are in mg/l unless otherwise noted.

-	:	Calculation yielded negative result
*	:	Includes scarfing flow
0	:	Included in average
NA	:	Not analyzed
+	:	Cannot be evaluated

NOTES: a. Negative values counted as zero in average calculations.
b. Because of the difficulty in sampling the raw wastes directly from the operations, the sampling results shown above are all based on the mills' discharge from the primary scale pits.

TABLE V-4

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HOT FORMING-SECTION
NET CONCENTRATION OF POLLUTANTS IN RAW WASTEWATERS(1)

Reference Code:	0176	0860H	0860H	0432A	0684H	0684H	0684H	0684H	0684H	0176		Overall(3)
Plant Code :	081-1&2	083 St.	083 Rod	087-14"	088-10"/11"	088-34"	088-36"Billet	088-32"	088-14"	081-#4Hot		
Sample Points :	(C-D)	(G-B-A)	(K-B-R-A)	(D-B)	(T-V)	(F-Q)	(D+E-Q)	(G-Q)		(F-A)(2)	Average	Average
Flow (gal/ton):	3570	4690	6930	6340	3400	580	3050	930	4800	8229	4152	4867
Suspended Solids	0	26	199	23	34	20	18	27	Unable	84	47.8	46.9
Oil & Grease	4	37	8	1	10	-	-	7	to	251	35.3	16.6
pH (Units)	7.9	6.9	7.4	7.3	7.5	7.7	7.9	7.8	Determine	7.2	6.9-7.9	5.1-8.4
Cadmium	0.0	0.0	0.0	+	0.01	0.0	-	0.0		0.0	*	*
Copper	0.07	0.05	0.07	0.024	0.01	0.06	0.2	0.06		0.11	0.07	0.040
Nickel	0.16	0.0	0.07	+	0.01	0.08	0.05	0.03		0.8	0.15	0.094
Zinc	-	0.0	0.02	0.15	0.2	0.02	0.0	0.0		0.04	0.05	0.029
Methylene Chloride	-	-	-	0.0	0.19	0.006	0.19	0.013		-	0.044	0.044
Naphthalene	0.0	-	0.0	0.0	0.01	0.010	0.002	0.0	-	-	*	*
2,4 Dinitrophenol	-	-	0.0	0.0	0.019	0.013	0.0	0.005		0.0	*	*
Bis(2-Ethylhexyl)phthalate	0.015	-	-	0.02	1.28	-	-	0.37		0.15	0.19	0.19
Butyl Benzyl Phthalate	0.014	-	-	-	0.0	-	-	-		0.0	*	*
Dimethyl Phthalate	0.0	-	-	-	0.011	0.0	0.005	0.005		0.0	*	*
Pyrene	0.005	-	0.005	-	-	0.0	-	-		0.0	*	*

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(1) All values are in mg/l unless otherwise noted.
(2) Some company supplied analytical data was used for net concentration calculation.
(3) Average of all values on Tables V-3 and V-4.

* : Average is less than 0.010 mg/l
+ : Cannot be evaluated
- : Calculation yielded negative results

NOTE: Because of the difficulty in sampling the raw wastes directly from the operations, the sampling results shown above are all based on the mills' dischrge from their primary scale pit.

TABLE V-5

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING - HOT STRIP & SHEET
NET CONCENTRATION OF POLLUTANTS IN RAW WASTEWATERS(1)

Reference Code	0248B	0020B	0860H	0060	0384A	0396D	
Plant Code	D	E	I-2	L-2	M-2	N-2	
Sample Points	(6-1)	(7-10)	(1+3+4)-6	(1-2)	(2+3)-5	(6-7)	Average
Flow (gal/ton)	3314	4518	7848	4525	8436	7273	5986
Suspended Solids	31	23	6.6	11	11	15	16.3
Oil & Grease	16.4	13.6	0.6	4.2	1.7	0.0	6.1
pH	6.3	5.9-6.1	7.3-8.3	7.6-8.1	8.4	7.3-7.5	5.9-8.4
Chromium	NA	NA	NA	NA	NA	NA	NA
Copper	0.00	0.00	NA	NA	NA	NA	0.00
Mercury	NA	NA	0.00	0.00	0.00	0.00	0.00
Nickel	0.13	0.00	NA	NA	NA	NA	0.00
Zinc	0.00	0.00	NA	NA	NA	NA	0.00

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(1): All values are in mg/l unless otherwise noted.
NA : Not Analyzed

TABLE V-6

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
TOXIC POLLUTANT SURVEY
HOT FORMING: FLAT-HOT STRIP AND SHEET
NET CONCENTRATIONS OF POLLUTANTS IN RAW WASTEWATERS(1)

Reference Code	0112D	0432A		Overall(2)
Plant Code	086(80" Mill)	087 (44" Mill)	Average	Average
Sample Points	(B-A)	(C-B)		
Flow (gal/ton)	5,719	UNK	5,719	5,948
Suspended Solids	41	18	30	19.7
Oil and Grease	6	3	4	5.6
pH (Units)	8.0-8.1	7.4-7.6	7.4-8.1	5.9-8.4
Beryllium	NA	+	+	+
Cadmium	0	+	+	+
Chromium	+	+	+	+
Copper	-	0.011	0.005	0.002
Lead	+	+	+	+
Nickel	+	+	+	0.06
Silver	+	+	+	+
Zinc	+	+	+	0.06
Phenolic Compounds	0.002	0.046	0.024	0.024
Chloroform	-	0.018	0.009	0.009
Methylene Chloride	+	+	+	+
2,4-Dinitrophenol	0.028	0	0.014	0.014
Bis-(2-ethyl hexyl) phthalate	0.279	0	0.140	0.140
Butyl benzyl phthalate	0.024	0	0.012	0.012
Di-n-butyl phthalate	0.001	0.023	0.012	0.012

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(1) All values are expressed in mg/l unless otherwise noted.
(2) Average of all values on Tables V-5 and V-6.

NA: Not Analyzed
+ : Cannot be evaluated
- : Calculations yielded a negative value

TABLE V-7

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING - PLATE
NET CONCENTRATION OF POLLUTANTS IN RAW WASTEWATERS(1)

				Average
Reference Code	0856H	0176	0868B	
Plant Code	F	O	K-2	
Sample Points	(7-9)	(10-11)	(1-2)	
Flow (gal/ton)	4293	12,800	3,692	6,928
Suspended Solids	85	79	56	73.3
Oil & Grease	50.9	0.00	4.6	18.5
pH (units)	6.3-6.7	7.4-7.5	6.9-7.1	6.3-7.5
Chromium	0.01	NA	NA	0.01
Copper	NA	0.00	NA	0.00
Mercury	NA	NA	0.00	0.00
Nickel	0.48	0.00	NA	0.24
Zinc	0.02	0.00	NA	0.01

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(1) : All values are in mg/l unless otherwise noted.
NA : Not Analyzed

NOTE: Because of the difficulty in sampling the raw wastes directly from the operations, the sampling results shown above are all based on the mills' discharge from the primary scale pit.

TABLE V-8

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
TOXIC POLLUTANT SURVEY
HOT FORMING: FLAT-PLATE
NET CONCENTRATIONS OF POLLUTANTS IN RAW WASTEWATERS[1]

Reference Code	0496	0496	0496	0496	0496	0860H	0112D		
Plant Code	082-112"/120"	082-112"/120"	082-140"	082-140"	082-140"/206"	083-30"	086-160"		Overall[2]
Sample Points	(D-A)	(C-A)	(H-A)	(G-A)	(J-A)	I-(B+A)	(H-A)	Average	Average
Flow (gal/ton)	869	2,653	118	144	206	9,821	3,221	2,433	3,782
Suspended Solids	22	31	65	109	25	12	30	42	51.4
Oil and Grease	8	6	34	60	4	10	13	19	18.9
pH (Units)	7.2	7.5	7.7-8.9	7.8	7.4	7.2-7.3	8.0-8.2	7.2-8.9	6.3-8.9
Chromium	+	0.09	0.04	0.04	0.01	-	+	0.03	0.027
Copper	0.18	0.15	0.11	0.18	0.20	0.06	0.02	0.13	0.11
Lead	+	+	0.21	0.42	+	+	+	0.09	0.09
Nickel	0.10	0.27	0.32	0.93	0.12	0.01	0.04	0.26	0.26
Silver	+	+	+	+	+	+	+	+	+
Zinc	0.05	0.04	0.03	0.05	0.05	0.04	0.01	0.04	0.033
Benzene	0.017	0.009	-	-	-	-	0	0.004	0.004
2,4-Dimethylphenol	0.014	0	0	0	0	0.005	0	0.003	0.003
Methylene Chloride	-	NA	0.002	0.116	0.014	-	+	0.022	0.022
4-Nitrophenol	0	0.017	0	0	0	-	0.007	0.003	0.003
Pentachlorophenol	0.012	0	0.005	0	0	-	0	0.002	0.002
Bis-(2-ethyl hexyl) phthalate	0.599	0.604	0.149	0.254	0.006	-	0.816	0.347	0.347
Di-n-butyl phthalate	-	0.032	-	-	-	0	0	0.005	0.005
Diethyl phthalate	0	0	0	0	0	0.023	0	0.003	0.003

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(1) All values are in mg/l unless otherwise noted.
(2) Average of all values in Tables V-7 and V-8.

-: Calculations yielded a negative value
+: Cannot be evaluated
NA: Not Analyzed

TABLE V-9

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
ORIGINAL GUIDELINES SURVEY
HOT WORKING PIPE AND TUBE
NET CONCENTRATIONS OF POLLUTANTS IN RAW WASTEWATERS(1)

Reference Code	0196A	0240B	0916A	0728	0256G	Average
Plant Code	E-2	GG-2	II-2	JJ-2	KK-2	
Sample Points	(1-6)	(1-4)	(1-5)	2-(1+3)	(1-3)	
Flow (gal/ton)	12,800	1,700	2,760	2,290	520	4,010
Suspended Solids	27	40	224	102	61	91
Oil and Grease	13.4	7.3	2.2	6.7	-	5.9
pH (Units)	8.2-8.7	7.0-7.8	7.0	6.8-6.9	6.8-7.1	6.8-8.7
Beryllium	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA
Phenolic Compounds	NA	NA	NA	NA	NA	NA

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(1) All values are expressed in mg/l unless otherwise noted
-: Calculations yielded a negative value
NA: Not Analyzed

TABLE V-10

SUMMARY OF ANALYTICAL DATA OF SAMPLED PLANTS
TOXIC POLLUTANT SURVEY
HOT WORKING PIPE AND TUBE
NET CONCENTRATIONS OF POLLUTANTS IN RAW WASTEWATERS[1]

Reference Code	0432A	0684H		Overall Average[2]
Plant Code	087	088	Average	
Sample Points	(E-B)	(I+J+K+L)-Q		
Flow (gal/ton)	8,080	7,010	7,540	5,020
Suspended Solids	27	31	29	73
Oil and Grease	2	1.9	2	4.8
pH (Units)	7.1-7.4	7.2-7.8	7.1-7.8	6.8-8.7
Beryllium	0.010	NA	0.010	0.010
Cadmium	+	*	+	+
Chromium	+	+	+	+
Copper	0.029	0.060	0.044	0.044
Lead	0.27	0.012	0.14	0.14
Nickel	+	0.069	0.069	0.069
Silver	+	0.0	0.0	0.0
Zinc	0.13	0.037	0.084	0.084
Phenolic Compounds	0.0020	0.078	0.040	0.040

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(1) All values are expressed in mg/l unless otherwise noted
(2) Average of all values in Tables V-9 and V-10
+ : Cannot be evaluated
NA: Not Analyzed

TABLE V-11

SUMMARY OF NET RAW WASTE CONCENTRATIONS(1)
HOT FORMING SUBCATEGORY

Parameter	Primary	Section	Hot Strip & Sheet	Plate	Pipe & Tube
Total Suspended Solids	77.0	46.9	19.7	51.4	73
Oil & Grease	37.4	16.6	5.6	18.9	4.8
pH (Units)	2.6-8.9	5.1-8.4	5.9-8.4	6.3-8.9	6.8-8.7
Chromium	0.04	0.0088	*	0.027	+
Copper	0.22	0.040	*	0.11	0.044
Lead	0.28	*	*	0.09	0.014
Nickel	0.23	0.094	0.06	0.26	0.069
Zinc	0.032	0.029	*	0.033	0.084
Phenolic Compounds	*	*	0.024	*	0.040
Methylene Chloride	0.020	0.044	*	0.022	*
2,4-Dinitrophenol	*	*	0.014	*	*
Bis-(2-ethyl hexyl) phthalate	0.071	0.019	0.140	0.347	*
Butyl benzyl phthalate	*	*	0.012	*	*
Di-n-butyl phthalate	*	*	0.012	*	*
Tetrachloroethylene	0.063	*	*	*	*

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(1) All values are in mg/l unless otherwise noted

*: Average value is less than 0.010 mg/l
+: Cannot be evaluated

HOT FORMING SUBCATEGORY

SECTION VI

WASTEWATER POLLUTANTS

Introduction

This section describes the selection, rationale for selection, and the process sources of those pollutants characteristic of hot forming operations. As a first step in the selection procedure, the Agency developed a list of pollutants considered to be most representative or characteristic of hot forming processes. This initial list of pollutants was confirmed and augmented with data collected from extensive field sampling programs which included analysis for toxic pollutants. A review of the analytical data from all of the field sampling programs formed the basis for the final selection of pollutants for hot forming operations. On the basis of the expected and observed similarities among hot forming operations, a common list of selected pollutants was then developed for the four hot forming subdivisions.

Conventional Pollutants

Suspended solids, oil and grease, and pH were the three pollutants limited by the BPT limitations promulgated in 1976. Suspended solids was chosen as a limited pollutant based upon the large quantities of scale generated in all of the hot forming processes. As noted in Section V, these scale particles enter the process wastewaters as a result of the application of water on the steel product and roll stands. Suspended solids also indicate the degree of process wastewaters contamination and can be used as a measure of treatment performance. Various other pollutants, including the toxic metals, are often entrained within the suspended particulate matter thus, suspended solids removal results in the removal of other pollutant levels.

The Agency selected oil and grease since many lubricants are used in hot forming processes. Oils and greases are present in hot forming wastewaters as a result of oil conditioning, oil spills, line breaks, excessive application of lubricants, and equipment washdown.

Finally, pH, a measure of the acidity or alkalinity of a wastewater, was chosen due to the environmentally detrimental effects which can result from extremes in pH. In addition, extremes in pH can cause problems, such as corrosion and scaling, to process and wastewater treatment equipment and facilities. The pH of hot forming process wastewaters typically falls within the range of 6.0 to 9.0 without control.

Toxic Pollutants

This study also considered the discharge of toxic pollutants. Initially, all pollutants classified as "known to be present" were included. This classification was made on the basis of industry responses to the DCPs, and analyses performed during the screening phase of this project. Table VI-1 lists toxic pollutants selected on the basis of the above considerations.

Upon completion of the analyses of the hot forming wastewaters for the various pollutants, the Agency determined those pollutants which were found at 0.010 mg/l or greater in the raw wastewaters. The final toxic pollutant list was developed by including pollutants detected in hot forming wastewaters at average concentrations of 0.010 mg/l or greater. This list, which includes the original BPT limited pollutants, is presented in Table VI-2. These pollutants are considered to be most representative and indicative of hot forming operations and are addressed accordingly throughout this report.

The toxic metal pollutants present as a result the raw materials used in the steelmaking and alloying processes, enter the hot forming process wastewaters when the product scale contaminates the process wastewaters. The five toxic metal pollutants (refer to Table V-11) included in the list are used to generally characterize all hot forming wastewaters. These toxic metals are found above treatability levels in the process wastewaters of all hot forming subdivisions. Control of these five predominant toxic metals will also indicate control of the other toxic metals, which could be present in wastewater from a particular plant. Toxic metals were found in wastewaters from both carbon and specialty mills.

The list of selected pollutants does not include any toxic organic pollutants. Although several toxic organic pollutants were detected at levels greater than 0.010 mg/l in some of the hot forming subdivisions, various factors mitigated against the selection of these pollutants. In the case of methylene chloride and the phthalates, these pollutants are considered to be artifacts (i.e., resulting from laboratory procedures) and are not contributed by hot forming operations. The remaining toxic organic pollutants (e.g., phenol, 2,4-dinitrophenol) were not included in the final list because of their presence at levels which indicate that, aside from recycle, specific treatment for organic pollutant removal is generally not feasible. The Agency believes that those pollutants do not tend to concentrate in recycle systems. Although the concentrations of those pollutants in recycle system blowdowns will be approximately the same as the discharge from once-through systems, the mass loadings of those pollutants will be reduced proportionately to the degree of recycle. Accordingly, with the high degree of recycle incorporated in the BCT, BAT, NSPS, PSES, and PSNS alternative treatment technologies, the Agency believes that compliance with the proposed limitations for toxic metal pollutants will indicate a comparable reduction in the discharge of those toxic organic pollutants present in hot forming wastewaters.

TABLE VI-1

PRIORITY POLLUTANTS KNOWN TO BE PRESENT HOT FORMING SUBCATEGORY

Priority Pollutant Numeric Designation	Pollutant Parameter
65	Phenol
66	Bis(2-ethylhexyl)Phthalate
85	Tetrachloroethylene
118	Cadmium
119	Chromium
120	Copper
121	Cyanide
122	Lead
123	Mercury
124	Nickel
125	Selenium
126	Silver
127	Thallium
128	Zinc

TABLE VI-2

SELECTED POLLUTANTS
HOT FORMING SUBCATEGORY

	Suspended Solids
	Oil and Grease
	pH
119	Chromium
120	Copper
122	Lead
124	Nickel
128	Zinc

HOT FORMING SUBCATEGORY

SECTION VII

CONTROL AND TREATMENT TECHNOLOGY

Introduction

A review of the control and treatment technologies currently in use or available for use in the hot forming subcategory provided the basis for the development of the BPT, BAT, BCT, NSPS, PSES, and PSNS alternative treatment systems. This review involved summarizing questionnaire and plant visit data to identify those treatment components and systems in use at hot forming operations. Capabilities, either demonstrated or based on treatment of similar wastewaters, were used in evaluating those advanced treatment technologies for toxic metal pollutant removal. The above considerations were then used to determine which treatment components and systems were most appropriate for the various levels of treatment. This section presents a summary of the treatment practices currently in use or available for use in the treatment of hot forming process wastewaters.

This section also presents raw wastewater and treated effluent data for the plants sampled, as well as the methods used to determine wastewater loads and actual raw wastewater quality. As noted previously, raw wastewater samples could only be obtained following primary scale pits at most plants. The analytical data, from the toxic pollutant surveys along with long-term effluent monitoring data from the industry, were used to establish treatment system capabilities. Also included in this section are descriptions of the treatment systems at each of the sampled plants.

Summary of Treatment Practices Currently Employed

As noted previously, wastewaters generated in the various hot forming processes are similar in character, and as a result, the treatment technologies in use at these operations are basically the same. A survey of the treatment components in use indicates that the following basic treatment units are prevalent: primary sedimentation, surface oil removal, secondary settling or filtration, and recycle. Over ninety-six percent of all hot forming operations have primary scale pits to collect and recover the heavier suspended particulate matter and to allow the tramp oils to float to the surface. These pits are cleaned either frequently or continuously in order to prevent excess solids accumulation. Slotted tube, rope, or belt-type oil skimmers are the principal devices in use for surface oil removal. The efficiency of scale pits is dependent upon design. In many mills a portion of the scale pit discharge is recycled to the process for flume flushing. The scale pit discharges which are not recycled, typically undergo physical/chemical treatment prior to discharge or recycle to the process.

Referring to Tables III-2 through III-7, the Hot Forming General Summary Tables, the following treatment technologies have been noted to be in use at many hot forming operations:

A. Scale Pit or similar type settling basin

Intended to provide primary sedimentation of the raw process wastewaters and oil separation.

B. Surface Skimming

The various tramp oils inherent in mill operations are removed from the surface of the wastewater (generally during primary settling).

C. Clarifiers or Thickeners

These components provide additional suspended solids removal. Settling lagoons and secondary scale pits are also capable of providing the same degree of treatment as clarifiers or thickeners.

D. Vacuum Filters

These filters are used to dewater the sludges removed from various sedimentation operations, principally clarifiers and thickeners.

E. Filters

These components can provide a much higher degree of suspended solids removal than attainable with sedimentation facilities.

F. Recycle

A portion of the effluent from one or more of the treatment system components is recycled to the process.

Hot forming wastewaters are often treated in central treatment facilities in which wastewaters from several hot forming mills (or, in many instances, from other subcategories) are combined for treatment. With this type of facility, advantage can be taken of the economies of scale and the ease of centralized process control.

Control and Treatment Technologies for BAT, BCT, NSPS, PSES, and PSNS

In order to achieve the high wastewater recycle rates for hot forming operations, an evaporative cooling tower is normally used to reduce the temperature of the recycled water. It should be noted that cooling towers are used at many hot forming operations as major components in high recycle rate systems. Heat load reduction is necessary to ensure sufficient roll cooling capacity and to minimize fog formation in the mill. Some mills practice a high degree of recycle without cooling towers.

Because of the presence of toxic organic and toxic metal pollutants in hot forming process wastewaters, the Agency considered advanced levels of treatment in the BAT, NSPS, PSES, and PSNS alternative treatment systems beyond recycle. Each of the technologies considered are reviewed below.

Sulfide Precipitation

The addition of sulfide compounds has been shown to result in a greater degree of toxic metals removal than can be achieved with typical flocculation and sedimentation procedures. Some of the toxic metals which can be effectively precipitated with sulfide are zinc, copper, nickel, lead and silver. The increased removal efficiencies can be attributed to the comparative solubilities of metal sulfide with metal hydroxides. In general, the metal sulfides are less soluble than the respective metal hydroxides. It must be noted, however, that an excess of sulfide may result in objectionable odor problems. A decrease in wastewater pH will aggravate this problem, and if process control problems result in an acidic pH, operating personnel can be affected. One method of controlling excess sulfide addition involves the use of a ferrous sulfide slurry addition. Ferrous sulfide will not readily dissociate in the waste stream with the result that the free sulfide level is kept well below objectionable limits. However, the affinities of the other metals in the waste stream for sulfide are greater than that of iron, with the result that other metal sulfide precipitates are formed preferentially to iron sulfide. Once the sulfide requirements of the other metal precipitates are satisfied, the remaining sulfide remains in the ferrous sulfide form and the excess iron from the ferrous sulfide is precipitated as a hydroxide. With the use of filtration following sulfide addition, significant toxic metal reductions can thus be achieved.

Evaporation

Vapor compression distillation, in which a wastewater with a high dissolved solids level (the treatment system blowdown) is concentrated to a slurry consistency, was considered as an alternate means of attaining zero discharge in the hot forming subcategory. The resulting slurry would be dried by various means while the distillate quality effluent would be recycled to the process. However, this technology did not receive further consideration because of excessive energy requirements and high cost. Zero discharge is being achieved at many hot forming operations without this technology.

Summary of Analytical Data

Raw wastewater and effluent data for the hot forming operations which were visited are presented by subdivision in Tables VII-2 through VII-11. Table VII-1 provides a legend for the various control and treatment technology abbreviations used on the above tables and in other tables throughout this report. The concentration values presented represent, except where footnoted, averages of measured values. In some cases these data were obtained from central treatment systems.

In several instances, the effluent waste loads (lbs/1000 lbs) for certain central treatment operations indicated on the analytical data tables represent apportioned loads. In these central treatment systems, the Agency determined the percentage contribution of an individual operation to the total treatment system influent load and subsequently applied this contribution to the total effluent load. This procedure was repeated for each pollutant. By using this procedure, the Agency assessed the effects of treatment on the waste loads of an individual process which discharges to a central treatment facility.

As a supplement to the sampled plant analytical data, long-term effluent analytical data from D-DCPs are presented on Table VII-12. These data are presented as a means of demonstrating treatment capabilities and consistency over an extended period.

As mentioned previously nearly all raw wastewater samples were obtained from primary scale pit effluents. Therefore, other methods were needed to determine raw process wastewater characteristics. Data provided by the D-DCP respondents served as the basis for establishing the levels of raw wastewater suspended solids and oil and grease.

Since suspended solids in hot forming wastewaters are almost entirely due to scale generation in the hot forming process, a determination of the quantities of scale generated provides a reasonable estimate of suspended solids levels present in process wastewaters. As a result of similar scale generation rates and wastewater characteristics, the Agency averaged mill scale generation data from all D-DCP respondents to derive a single scale generation rate for application to all hot forming operations. These data are presented in Table VII-13. The average product loss of approximately 2.1% represents a scale generation rate and resulting suspended solids loading of 42 lbs of solids per ton of production. This solids loading was then applied to the various treatment model sizes and raw wastewater flow rates to determine raw wastewater suspended solids levels for each treatment system. It must be noted that the above rate applies only to mills without machine scarfer operations. A review of available information indicates that primary mills with scarfing operations generate about twice as much suspended solids than those systems without scarfing.

Raw wastewater oil and grease levels were also established on the basis of data provided in the D-DCP responses. Virtually all of the oils and greases present in hot forming wastewaters are present as a result of leakages or spills of oils (i.e., lubricants) which are immiscible in water. Based on the data received from the D-DCP respondents, the Agency determined an average oil and grease generation rate of 0.23 gallons/ton (Table VII-13). This volume is equivalent to a mass generation rate of 1.6 lbs/ton. This rate was applied to each treatment system as discussed above for suspended solids. Oil generation rates much greater than this value are considered to be the result of inadequate maintenance and operational control.

Plant Visits

Brief descriptions of the visited plants are presented below. Treatment system flow schematics are provided at the end of this section.

Plant C - Figure VII-1 (Section)

The wastewaters from the specialty bar mills at Plant C empty into a cooling reservoir which receives wastewaters from other processes as well. A portion of the reservoir overflow is discharged to a receiving stream, while the remaining overflow is recycled to the process.

Plant D - Figure VII-2 (Primary)

Universal mill (specialty) wastewaters discharge to a scale pit equipped with oil removal facilities. The scale pit effluent of this once-through system is discharged to a receiving stream.

Plant D - Figure VII-3 (Flat)

This plant provides once-through treatment for specialty hot strip mill wastewater. Wastewater is pumped to primary scale pits and then discharged to a receiving stream after mixing with wastewater from the universal mill mentioned above.

Plant E - Figures VII-4 and VII-5 (Primary and Flat)

Specialty steel hot strip, blooming and universal mills are treated in a central treatment system. After first passing through primary scale pits, the wastewaters then discharge to a main collection sump which discharges to two clarifiers. The clarifier overflow is pumped through deep bed filters and then discharged to a receiving stream. The filter backwash is returned to the clarifiers.

Plant F - Figure VII-6 (Flat)

Plant F has a once-through process wastewater system for a specialty plate mill. Wastewaters flow through a primary scale pit and then are discharged to a receiving stream. Reheat furnace noncontact cooling water also flows through the primary scale pit.

Plant H - Figure VII-7 (Primary)

Plant H practices once-through treatment of its specialty steel blooming mill wastewaters. Scarfer wastewater, reheat furnace cooling water, and blooming mill wastewater all empty into the same scale pit and discharge to a receiving stream.

Plant H - Figure VII-8 (Section)

Merchant mill wastewaters are pumped to a scale pit and discharged to a receiving stream by this specialty mill. No recycle is employed at this mill.

Plant K - Figure VII-9 (Primary)

The treatment facility for this specialty blooming mill incoporates a recycle system with a blowdown to a receiving stream. Treatment includes a primary scale pit with oil removal facilities.

Plant K - Figure VII-10 (Section)

This specialty bar mill's process effluent discharges to a scale pit from where it is discharged to a receiving stream. No recycle is employed at this mill.

Plant M - Figure VII-11 (Primary)

This specialty steel plant's wastewater treatment system serves primary and section rolling mills (blooming mill, billet mill, and bar mill).

The primary mill wastewaters, including hot scarfer wastewater, are discharged to a primary scale pit. The scale pit effluent is recycled to the mills and hot scarfer with a blowdown going to a sump pit which receives section mill wastewaters. Overflow from this sump pit is discharged to a spray pond and to a POTW. Water is recycled from the spray ponds to the mills after addition of cooling water makeup.

Plant M - Figure VII-12 (Section)

The wastewater treatment system for this specialty plant serves several mills including a billet bar mill, a blooming mill and a bar mill. Bar mill wastewater is pumped to a sump pit along with other mill wastewaters. A portion of the sump pit effluent is discharged while the remainder is pumped to a spray pond and is subsequently recycled.

Plant O - Figure VII-13 (Section)

This specialty mill's wastewaters are discharged to a clarifier for sedimentation. A blowdown is discharged from the clarifier to a central wastewater treatment facility. The remainder of the clarifier overflow is recycled.

Plant O - Figure VII-14 (Section and Flat)

The wastewater treatment system for these specialty mills is a combined system serving both rod and strip mills. Wastewaters are discharged to a scale pit, then recycled to these mills. A blowdown is discharged to a central wastewater treatment facility.

Plant Q - Figure VII-15 (Primary)

This specialty blooming mill employs a once-through system which uses a scale pit and oil skimming equipment to treat process wastewaters. Other plant process wastewaters discharge to the scale pit as well. The scale pit overflow is discharged to a receiving stream.

Plant Q - Figure VII-16 (Section)

The wastewaters from the specialty bar mills at Plant Q are delivered to a scale pit equipped with oil removal facilities. As no recycle is employed, all process wastewaters are discharged from the scale pit to a receiving stream.

Plant R - Figure VII-17 (Primary)

This specialty plant's treatment system serves several mills including primary and section rolling mills (blooming mill and bar mills).

Blooming mill wastewaters are discharged to a common primary scale pit. The scale pit effluent is discharged to a settling lagoon for final polishing. This system is once-through.

Plant R - Figure VII-18 (Section)

Wastewaters from the two specialty bar mills at this plant are discharged to two separate scale pits which in turn discharge to a common scale pit. Wastewaters from this scale pit are pumped to a settling lagoon, then discharged to a receiving stream. No recycle is employed.

Plant A-2 - Figure VII-19 (Primary and Section)

The wastewater treatment system for this plant serves a combination of hot forming mills (billet and rail mills). The wastewaters from each of the mills pass through primary scale pits and are then discharged into a secondary clarification device called a settling cone. The settling cone is elevated to allow for gravity flow to the deep bed filters. A portion of the settling cone overflow is recycled to the hot forming mills with the balance going to the deep bed filters. Filter effluent is discharged to a lake. Filter backwash is discharged back into the primary scale pits.

Plant B-2 - Figure VII-20 (Primary)

This treatment is identical to that of Plant A-2 except that no recycle is employed.

This treatment facility is a combination system serving both blooming and structural mills, although the structural mill was not operating at the time of sampling. Wastewater passes through primary scale pits and then is discharged to a settling cone. The settling cone is elevated to allow for gravity flow to the deep bed filters. The settling cone effluent is discharged to the deep bed filters and the filter effluent is then discharged to a lake. Filter backwash is discharged back into the primary scale pits.

Plant C-2 - Figure VII-21 (Primary)

Wastewaters from this blooming mill are discharged to a primary scale pit. The scale pit overflow is then pumped to a pressure (media) deep bed filter which discharges to a receiving stream. Filter backwash is discharged to clarifiers for final sedimentation. Clarifier overflow is also discharged. No recycle is employed.

Plant D-2 - Figure VII-22 (Primary and Section)

The wastewater treatment system for Plant D-2 serves several hot forming mills including a blooming mill, two merchant bar mills, and a bar mill. The wastewaters from each of the mills pass through primary scale pits and then discharge to the thickener. The bar mill wastewater, though, is recycled to the process prior to the thickener. Also, one of the merchant bar mills' wastewater bypasses the thickener and combines with the thickener overflow. The thickener underflow is discharged to a blast furnace thickener. The rolling mill's thickener overflow is discharged to a central scale pit equipped with oil collection facilities. The wastewaters are then discharged to deep bed filters. The blast furnace thickener overflow is processed through a cyanide destruction system and then filtered in the same deep bed filtering system. The filter effluent is then pumped to a main plant recycle pumping station where river makeup is added and the wastewaters are then recycled to the hot forming mills. The remaining filter effluent is reused for noncontact blast furnace cooling and then discharged.

Plant E-2 - Figure VII-23 (Section and Pipe and Tube)

Rod mill, bar mill, and seamless tube mill wastewaters are treated by this combination system. Wastewaters discharge to a primary settling basin from which they are pumped to a clarifier. Clarifier overflow is then filtered by six high rate sand filters. Filter backwash and clarifier underflow are taken to settling pits and a lagoon which empties into the main reservoir. The filter effluent is recycled to only the rod and bar mills after first passing through a cooling tower. Makeup to the system is provided by a main reservoir which also accepts any blowdown from the system. The reservoir overflow is discharged to a receiving stream.

Plant F-2 - Figure VII-24 (Section)

Section mill wastewaters first pass through a series of primary and secondary scale pits which are equipped with oil removal facilities. Scale pit effluent is pumped to clarifiers for quiescent settling. Oil skimming is also practiced at the clarifiers. The clarifier overflow is recycled to the process after first passing through a two-cell cooling tower. Clarifier underflow is dewatered using vacuum filters and the filtrate is returned to the clarifiers. The cold well of the cooling tower provides the point of treatment system blowdown.

Plant G-2 - Figure VII-25 (Section)

Wastewaters from the 10" and 12" bar mills first pass through scale pits. Scale pit effluents are pumped to two settling basins equipped with waste ejectors and oil skimmers. Overflow from the settling basins is pumped to three wastewater strainers. Strainer backwash water is conveyed to a dirty water sump which follows the scale pits. Strainer effluent is recycled to the process after first passing through a cooling tower. Makeup water from the river is added to the inlet sump. There is no discharge from this system.

Plant H-2 - Figure VII-26 (Section)

Rod mill wastewaters are discharged to a scale pit. The effluent from the scale pit is pumped to five cyclones which discharge to a receiving stream. This system is once-through with no recycle.

Plant I-2 - Figure VII-27 (Section)

The wastewater treatment system for this plant is a combination system treating both section mill and pickling wastewaters. Rod mill wastewater is first sent to a scale pit. The scale pit effluent is then discharged to a terminal settling lagoon which receives pickling wastewater as well. All process effluent is discharged to a receiving stream.

Plant J-2 - Figure VII-28 (Flat)

The wastewater treatment system for Plant J-2 serves two carbon steel hot strip and sheet mills, one, an 84" hot strip mill and the other, an 80" hot strip mill.

The wastewaters from the 84" hot strip mill reheat furnaces, roughing mill stands, and motor room flume flush are discharged to a roughing scale pit system with both primary and secondary scale pits. The overflows from these scale pits are discharged to a receiving stream. Oily wastewaters from the 84" mill motor room are discharged to a terminal treatment system which removes the oil and pumps the water to the receiving stream. The 84" mill finishing stands and a portion of the runout tables wastewaters are pumped to the 84" finishing scale pit. Also, the overflows from the 80" finishing and roughing scale pits are routed to this same scale pit. The balance of the 84" hot strip runout table and coilers wastewater is discharged to a three compartment scale pit. Part of this scale pit's effluent is taken to the 84" mill finishing-scale pit, while the remaining portion is discharged to a receiving stream. Finally, the overflow from the 84" finishing scale pit is pumped to gravity media filters and then discharged to a receiving stream. Filter backwash water is treated in a clarifier and returned to the 84" mill finishing scale pit. Clarifier underflow is dewatered by vacuum filters.

Plant K-2 - Figure VII-29 (Flat)

The wastewater treatment system for this operation serves a carbon steel 160" plate mill. Wastewaters from the 160" plate mill pass through primary scale pits and are discharged into two secondary scale pits. The primary scale pits are baffled and have oil removal and collection facilities. The sludge from the secondary scale pits is discharged to a thickener and the thickener overflow is returned to the secondary scale pits. The effluent from these scale pits is pumped through high rate media filters and then recycled to the plate mill after first passing through a cooling tower. The treatment system blowdown is discharged to a receiving stream.

Plant L-2 - Figure VII-30 (Primary and Flat)

Primary and flat product rolling mill wastewaters are treated by this combination system. Treatment initially consists of primary scale pits equipped with oil collection facilities. The scale pit overflow is discharged to a mixing tank where lime and ferric sulfate are added. From the mix tank, wastewaters enter flocculator tanks which in turn discharge to flocculating clarifiers. The clarifier overflow is recycled to the mills after passing through a cooling tower where makeup water is added. Some of the recycle flow is blown down and some is also used as makeup water to fume scrubbers at the pickling facilities. Clarifier underflow is dewatered by vacuum filters with the filtrate being returned to the flocculator tanks.

Plant M-2 - Figure VII-31 (Flat)

The treatment system for this operation treats wastewaters from an 80" carbon steel combination hot strip and sheet mill. Wastewaters from the primary roughing mill stands and the secondary roughing mill stands are pumped to primary scale pits and then to a mixing tank for lime and ferric sulfate addition. Settling of the wastewater is accomplished in clarifiers where skimmed oils are collected and routed to an oil separator tank. The clarifier effluent is discharged to a receiving stream and the sludge is dewatered by vacuum filters.

Plant N-2 - Figure VII-32 (Flat)

The primary scale pit receives wastewaters from the roughing and finishing mill stands of this hot strip mill and then discharges the wastewaters to pressure media filters. Strip cooling and coiler wastewater is also discharged to a primary scale pit but is then recycled after first passing through a cooling tower. A blowdown from the cooling tower is delivered to the filters. Filtered water is recycled to the mill roughing and finishing stands. A clarifier receives the filter backwash. The clarifier overflow is returned to the filter inlet while the clarifier underflow is dewatered by vacuum filters. A blowdown is discharged to a POTW.

Plant GG-2 - Figure VII-33 (Pipe and Tube)

This plant is a seamless pipe mill producing specialty steel seamless pipe from reheated billets. This pipe mill practices 100% recycle and utilizes primary sedimentation (scale pits), oil separation (API separators) and sedimentation in a lagoon. Wastewaters are recycled to the pipe mill from the lagoon.

Plant II-2 - Figure VII-34 (Pipe and Tube)

This plant is a butt welded pipe mill producing carbon steel pipe from skelp. The butt welded pipe mill mixes noncontact and contact cooling waters and discharges its wastewaters on a once-through basis to a double compartment scale pit which is equipped with oil skimming facilities. The scale pit effluent is then pumped to radial, media type pressure filters. The filtered water is discharged to a final settling lagoon. The filter backwash is discharged to a clarification tank where neutralization is provided along with polymer addition. The clarification tank then discharges back into the scale pits. The filtered effluent is discharged to a receiving stream.

Plant JJ-2 - Figure VII-35 (Pipe and Tube)

This plant is a butt welded pipe mill producing carbon steel pipe from skelp. The pipe mill mixes pickling rinse wastewaters with primary scale pit effluent and discharges the mixed wastewaters to a settling lagoon. The lagoon overflow is pumped to a storage tank which recycles all of the wastewaters to the butt welded pipe mill. Service makeup water and lime are added to the recycled water. Solids from the scale pit and lagoon are landfilled.

Plant KK-2 - Figure VII-36 (Pipe and Tube)

This plant is a butt welded pipe mill producing carbon and low alloy pipe from skelp. This pipe mill provides once-through treatment with primary and secondary scale pits. The primary scale pit has oil skimming facilities and is also equipped for the addition of polymer. The secondary scale pit discharges to a receiving stream.

Plant 081 - Figure VII-37 and VII-38 (Primary and Section)

The wastewater treatment system for this plant provides treatment for a combination of hot forming mill (primary and section rolling mills), combination acid pickling, kolene and hydride descaling, wire pickling and coating, and continuous alkaline cleaning wastewaters.

The wastewaters from the primary and section rolling mills are discharged to a "Lamella" separator after passing through primary scale pits. The overflow from the separator is recycled to the primary and section rolling mills. The blowdown from the separator is discharged to a central wastewater treatment system which also treats the wastewaters described above. Makeup water is added to the "Lamella" separator and section mills as required. It should be noted that the effluent analytical data presented in this section's tables represent only the discharge from the "Lamella" separator. These data thus depict hot forming wastewater treatment only.

Plant 082 - Figure VII-39 (Primary and Flat)

The wastewater treatment system for this plant serves a combination of carbon and specialty steel primary (slab) mills and flat (plate) mills. The mills are designated as 112"/120", 140", and 140"/206" combined. Samples were collected to differentiate between carbon and specialty steel production on the same mills. A 112" primary mill can either roll ingots or slabs to heavy plate which, in turn, is the feed stock to a 120" plate mill which provides a further reduction in plate size. A 140" primary mill can also roll either ingots or slabs into heavy plate which, in turn, is the feed stock for a 206" plate mill.

Wastewaters from the 112" mill and the 120" plate mill pass through primary scale pits and are discharged into a common secondary scale pit. Likewise, wastewaters from the 140" and the 206" plate mills flow to primary scale pits and subsequently to a combined secondary scale pit. Overflows from the secondary scale pits are discharged to three parallel settling basins. The effluent from the settling basins is then delivered to a set of gravity filters. The filtered effluent is discharged to a receiving stream. Filter backwash is delivered to a backwash settling basin which discharges to the three parallel settling basins.

Plant 083 - Figure VII-40 (Primary, Section, and Flat)

The wastewater treatment system for Plant 083 is a central facility which serves several hot forming mills and steelmaking facilities (i.e., BOF, electric arc furnace). The hot forming mills include primary, section, and plate rolling mills, (blooming mill, structural mill, plate mill, and rod mill). The blooming mill wastewaters are discharged to a main pump station after passing through primary scale pits equipped with oil removal facilities. The rod mill has its own treatment system and discharges only a blowdown to the central treatment system. Other mill wastewaters discharge to the main pump station. The combined wastewaters undergo treatment in flocculating clarifiers and are then recycled through a cooling tower to the various mills.

A portion of the clarifier effluent is blowndown to a POTW. The clarifier underflow is pumped to a thickener which, in turn, discharges to a sludge decant tank. After decanting, sludge is hauled away by private contractor. Overflow from the decant tank is returned to the thickener.

Plant 086 - Figure VII-41 (Flat)

The wastewater treatment system for these mills (an 80" hot strip mill and a 160" plate mill) is a central treatment facility serving steelmaking operations and two hot forming mills.

Wastewaters from the 80" hot strip mill primary and secondary roughing stands pass through a primary scale pit. The effluent from the primary scale pit is recycled to the roughing mill flumes. The roughing mill scale pit also has an overflow to the finishing scale pit. The two scale pits are separated by a concrete wall and are equipped with oil baffles and collectors. The overflow from the finishing scale pit is discharged to the central treatment clarifiers.

The 160" plate mill wastewaters pass through a primary scale pit, which also discharges to the clarifiers. Some of the scale pit effluent is recycled to the plate mill stands for flume flushing. The 160" plate mill also has in-line plate heat treatment facilities in which reheated plates pass through a quenching station. Some of the quench pit overflow is delivered to the central treatment facility via two sump pump stations on either end of the quench pits.

The central treatment clarifier overflow is discharged to two twenty-five million gallon terminal lagoons which in turn discharge to a receiving stream. During the time of sampling, the plant was in the process of installing a recycle pump system for the purpose of returning the terminal lagoon effluent to the mill complex.

Plant 087 - Figure VII-42 (Section, Flat, and Pipe and Tube)

This plant employs a central treatment system which serves a merchant mill, butt weld pipe mill, blooming mill, hot scarfer, and a hot strip mill. Wastewaters from the various sources first pass through their individual scale pits, which are equipped with baffles and oil removal equipment, and are then pumped to clarifiers. Coagulant aids are added at the clarifier inlet to assist in settling. The clarifier overflow is discharged to a receiving stream and the underflow is dewatered by vacuum filters. At the time of sampling all of the clarifier overflow was discharged to a receiving stream, although provisions have been made for a future recycle system.

Plant 088 - Figure VII-43 and VII-44 (Primary, Section, and Pipe and Tube)

The wastewater treatment system for Plant 088 serves a combination of hot forming mills and steelmaking facilities (i.e., vacuum degassing, electric arc furnace). The hot forming mills include primary, section, and seamless pipe and tube operations (blooming mills, three bar mills, and a rod mill).

The wastewaters from the 32" and 34" bar, blooming, billet, and pipe and tube mills are pumped to a collection sump after passing through primary scale pits equipped with oil collection facilities. The wastewaters are then pumped to deep bed pressure filters. The filter effluent is discharged to a pump station from where all of the wastewaters are recycled to the mills. The steelmaking, vacuum degassing, and other wastewaters are directed to the same pump station for reuse throughout the plant. Filter backwash is conveyed to clarifiers after passing through backwash storage and rapid mix tanks. Other rod mill, bar mill, and seamless tube finishing mill wastewaters are also pumped to the filter backwash clarifiers. The clarifier overflow is conveyed to the recycle pump station for return to the processes. The clarifier underflow is delivered to a thickener for further settling. The thickener underflow is dewatered by vacuum filtration while the thickener effluent is returned to the clarifiers. Makeup river water is added at the recycle pump house.

Wastewaters from the 10" rod and 11" bar mills are discharged to a common scale pit and then to a drag link conveyor. A large portion of the drag link conveyor effluent is recycled to the process after first passing through a retention basin. The rest of the drag link conveyor effluent is pumped to the filter backwash rapid mix tank and clarifiers. The clarifier overflow is recycled to the various mills. Clarifier underflow is conveyed to a thickener and is further dewatered by a vacuum filter. The two systems noted above blow down a small amount of wastewater (0.5%) to the 14" bar mill water system described below.

Separately, wastewaters from the 14" bar mill are first treated by two sets of scale pits (refer to Figure VII-44). One set receives wastewaters from the hot saws, shears, stands, pull rods, and bar rotators and then recycles these wastewaters to the process. The second set of scale pits accepts bar mill stands effluent and skip cooling water. A partial recycle is taken from the scale pits back to the process. The remainder of the scale pit effluent is pumped to a mix tank which then discharges to a clarifier. A large portion of the clarifier effluent is recycled to this bar mill. The remaining clarifier effluent is discharged to a POTW system. The clarifier underflow is discharged to a sludge pond.

TABLE VII-1

OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS

Symbols

A. Operating Modes

1. OT Once-Through

2. Rt,s,n Recycle, where t = type waste
s = stream recycled
n = % recycled

t: U = Untreated
T = Treated

	s	n
P	Process Wastewater	% of raw waste flow
F	Flume Only	% of raw waste flow
S	Flume and Sprays	% of raw waste flow
FC	Final Cooler	% of FC flow
BC	Barometric Cond.	% of BC flow
VS	Abs. Vent Scrub.	% of VS flow
FH	Fume Hood Scrub.	% of FH flow

3. REt,n Reuse, where t = type
n = % of raw waste flow

t: U = before treatment
T = after treatment

4. BDn Blowdown, where n = discharge as % of raw waste flow

B. Control Technology

10.	DI	Deionization
11.	SR	Spray/Fog Rinse
12.	CC	Countercurrent Rinse
13.	DR	Drag-out Recovery

C. Disposal Methods

20.	H	Haul Off-Site
21.	DW	Deep Well Injection

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT
TECHNOLOGIES AND DISPOSAL METHODS
PAGE 2

C. Disposal Methods (cont.)

22.	Qt,d	Coke Quenching, where t = type d = discharge as % of makeup t: DW = Dirty Water CW = Clean Water
23.	EME	Evaporation, Multiple Effect
24.	ES	Evaporation on Slag
25.	EVC	Evaporation, Vapor Compression Distillation

D. Treatment Technology

30.	SC	Segregated Collection
31.	E	Equalization/Blending
32.	Scr	Screening
33.	OB	Oil Collecting Baffle
34.	SS	Surface Skimming (oil, etc.)
35.	PSP	Primary Scale Pit
36.	SSP	Secondary Scale Pit
37.	EB	Emulsion Breaking
38.	A	Acidification
39.	AO	Air Oxidation
40.	GF	Gas Flotation
41.	M	Mixing
42.	Nt	Neutralization, where t = type t: L = Lime C = Caustic A = Acid W = Wastes O = Other, footnote

D. Treatment Technology (cont.)

43.	FLt	Flocculation, where t = type t: L = Lime A = Alum P = Polymer M = Magnetic O = Other, footnote
44.	CY	Cyclone/Centrifuge/Classifier
44a.	DT	Drag Tank
45.	CL	Clarifier
46.	T	Thickener
47.	TP	Tube/Plate Settler
48.	SLn	Settling Lagoon, where n = days of retention time
49.	BL	Bottom Liner
50.	VF	Vacuum Filtration (of e.g., CL, T, or TP underflows)
51.	Ft,m,h	Filtration, where t = type m = media h = head

t	m	h
D = Deep Bed	S = Sand	G = Gravity
F = Flat Bed	O = Other, footnote	P = Pressure

52.	CLt	Chlorination, where t = type t: A = Alkaline B = Breakpoint
53.	CO	Chemical Oxidation (other than CLA or CLB)

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT TECHNOLOGIES AND DISPOSAL METHODS
PAGE 4

D. Treatment Technology (cont.)

54.	BOt	Biological Oxidation, where t = type	t: An = Activated Sludge n = No. of Stages T = Trickling Filter B = Biodisc O = Other, footnote
55.	CR	Chemical Reduction (e.g., chromium)	
56.	DP	Dephenolizer	
57.	ASt	Ammonia Stripping, where t = type	t: F = Free L = Lime C = Caustic
58.	APt	Ammonia Product, where t = type	t: S = Sulfate N = Nitric Acid A = Anhydrous P = Phosphate H = Hydroxide O = Other, footnote
59.	DSt	Desulfurization, where t = type	t: Q = Qualifying N = Nonqualifying
60.	CT	Cooling Tower	
61.	AR	Acid Regeneration	
62.	AU	Acid Recovery and Reuse	
63.	ACt	Activated Carbon, where t = type	t: P = Powdered G = Granular
64.	IX	Ion Exchange	
65.	RO	Reverse Osmosis	
66.	D	Distillation	

TABLE VII-1
OPERATING MODES, CONTROL AND TREATMENT
TECHNOLOGIES AND DISPOSAL METHODS
PAGE 5

D. Treatment Technology (cont.)

67.	AA1	Activated Alumina
68.	OZ	Ozonation
69.	UV	Ultraviolet Radiation
70.	CNTt,n	Central Treatment, where t = type n = process flow as % of total flow t: 1 = Same Subcats. 2 = Similar Subcats. 3 = Synergistic Subcats. 4 = Cooling Water 5 = Incompatible Subcats.
71.	On	Other, where n = Footnote number
72.	SB	Settling Basin
73.	AE	Aeration
74.	PS	Precipitation with Sulfide

TABLE VII-2

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES SURVEY
HOT FORMING-PRIMARY

RAW WASTEWATERS

Reference Code :	0112B-01,02(1)		0112B-03(1)		0684H(1)		0946A(1)		0060(1)		0248B(1)		0020B	
Plant Code :	A-2		B-2		C-2		D-2		L-2		D		E	
Sampling Point(s):	4(2)		3		1		1+2		1(2)		8(3)		6	
Flow (gal/ton) :	890		510		780		700		610		535		2740	
	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#
Suspended Solids	103	0.38	61	0.13	26	0.085	49	0.14	16	0.041	161	0.36	109	1.24
Oil & Grease	17.3	0.064	151	0.32	8.8	0.029	19	0.055	12	0.031	59	0.13	28	0.32
pH (Units)	7.6		8.0-8.3		7.9-8.1		7.8-8.2		7.6-8.1		1.6-6.5		7.0-7.5	
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03	0.00034
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.19	0.0022
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.04	0.00046

EFFLUENTS

Reference Code :	0112B-01,02		0112B-03		0684H		0946A		0060		0248B		0020B	
Plant Code :	A-2		B-2		C-2		D-2		L-2		D		E	
Sampling Point(s):	2(2)		2		2		6(2)		2(2)		9		5(2)	
Flow (gal/ton) :	520		510		780		460		10.3		535		2740	
C&TT :	PSP,SS,Set.Cone FDP,RTP42		PSP,SS,Set.Cone FDP,OT		PSP,CL,FDS,OT		PSP,CL,FDP, RTP35		PSP,FLL,FLP,CL CT,RTP98		PSP,SS,OT		PSP,CL,FDP,OT	
	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#
Suspended Solids	1.6	0.0035	2.3	0.0049	5	0.016	23	0.044	4.9	0.00021	104	0.23	13	0.15
Flow (gal/ton)	1.7	0.0037	2.2	0.0047	6.7	0.022	8.3	0.016	7.9	0.00034	52	0.12	2.0	0.023
pH (Units)	7.6-8.0		7.7-7.8		7.6-7.7		8.1-8.2		8.6-8.7		2.5-6.4		5.8-6.6	
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03	0.00034
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03	0.00023

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(1) Data includes flow from scarfing operations.
(2) Sample includes wastewaters from hot forming operations other than primary.
(3) Sample of inlet to primary scale pit.

NA: Not Analyzed
* : Concentration is <0.010 mg/l

TABLE VII-2
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES SURVEY
HOT FORMING-PRIMARY
PAGE 2

RAW WASTEWATERS

Reference Code :	0248A(1)		0256K		0432J		0684D		0240A		Average$^{(4)}$	
Plant Code :	H		K		M		Q		R			
Sampling Point(s):	7+8$^{(3)}$		11$^{(3)}$		-		4$^{(2)}$		6$^{(3)}$			
Flow (gal/ton) :	2480		5600		4350		3420		4780		2280	
	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#
Suspended Solids	158	1.63	ANALYTICAL		NO SEPARATE		48	0.68	81	1.61	81	0.63
Oil & Grease	5.5	0.057					12.8	0.18	2.9	0.058	32	0.12
pH (Units)	5.8-6.2		DATA		SAMPLE OF		7.0-7.6		7.4-7.6		1.6-8.3	
Chromium	*	*	NOT		PRIMARY		0.54	0.0077	*	*	0.14	0.0020
Copper	0.02	0.00021					*	*	0.01	0.00020	0.01	0.00017
Lead	0.03	0.00031	AVAILABLE		WASTEWATERS		0.03	0.00043	0.03	0.00060	0.03	0.00042
Nickel	*	*					0.17	0.0024	0.07	0.0014	0.11	0.0015
Zinc	0.03	0.00031					0.08	0.0011	0.02	0.00040	0.04	0.00057

EFFLUENTS

Reference Code :	0248A		0256K		0432J		0684D		0240A	
Plant Code :	H		K		M		Q		R	
Sampling Point(s):	9		12		7$^{(2)}$		5$^{(2)}$		8$^{(2)}$	
Flow (gal/ton) :	2480		800		68		3420		4780	
C&TT :	PSP,OT		PSP,SS,RUP86		PSP,SSP,RUP90 RTP8.5		PSP,SS,OT		PSP,SL,OT	
	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#
Suspended Solids	137	1.41	ANALYTICAL		35	0.0099	29	0.41	45	0.90
Oil & Grease	2.3	0.024			27	0.0077	4.0	0.057	5.3	0.036
pH (Units)	6.2-6.3		DATA		5.8-6.3		7.2-7.6		7.4-7.5	
Chromium	*	*	NOT		0.24	0.00007	*	*	*	*
Copper	*	*			0.04	0.00001	0.02	0.00028	0.01	0.00020
Lead	0.03	0.00031	AVAILABLE		NA	NA	0.03	0.00043	0.03	0.00060
Nickel	*	*			0.15	0.00004	0.63	0.0090	0.05	0.0010
Zinc	0.01	0.00010			0.02	Neg.	0.07	0.0010	0.02	0.00040

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(1) Data includes flow from scarfing operations.
(2) Sample includes wastewaters from hot forming operations other than primary.
(3) Sample of inlet to primary scale pit.
(4) In calculating averages, all * data is included as 0.01 mg/l concentration, and the load equivalent to 0.01 mg/l is calculated for inclusion in the load averages.

NA : Not Analyzed
* : Concentration is <0.010 mg/l
Neg.: Negligible. Load is <0.00001 #/1000#

TABLE VII-3

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT SURVEY
HOT FORMING-PRIMARY

RAW WASTEWATERS

Reference Code	0496(1)		0496(1)		0860H		0684H(1)		0176		Average		Overall(2) Average	
Plant Code	082-140"		082-140"/206"		083		088		081					
Sampling Point(s)	G_1+H_1		H_2+J_2		E		B+C		B					
Flow (gal/ton)	170		460		320		1700		760		680		1810	
	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/10000#	mg/l	#/1000#
Suspended Solids	83	0.059	54	0.10	244	0.33	24	0.17	29	0.092	87	0.15	83	0.47
Oil & Grease	75	0.053	16	0.031	35	0.047	6.5	0.046	165	0.52	60	0.14	41	0.13
pH (Units)	7.7-7.8		2.6-8.9		7.0-7.1		7.9		7.9-8.1		2.6-8.9		1.6-8.9	
Chromium	0.05	0.00004	0.05	0.00010	0.12	0.00016	0.04	0.00028	0.13	0.00041	0.08	0.00020	0.10	0.0010
Copper	0.19	0.00013	0.30	0.00058	0.53	0.00071	0.21	0.0015	0.97	0.0031	0.44	0.0012	0.24	0.00074
Lead	0.40	0.00028	0.07	0.00013	0.07	0.00009	0.30	0.0021	0.81	0.0026	0.33	0.0010	0.20	0.00076
Nickel	0.57	0.00040	0.22	0.00042	0.09	0.00012	0.12	0.00085	0.55	0.0017	0.31	0.00070	0.22	0.0011
Zinc	0.08	0.00006	0.10	0.00019	0.10	0.00013	0.05	0.00035	0.14	0.00044	0.09	0.00023	0.07	0.00038

EFFLUENTS

Reference Code	0496		0496		0860H		0684H		0176	
Plant Code	082-140"		082-140"/206"		083		088		081	
Sampling Point(s)	O_1+P_1		P_2		B		(B+C/M)P		E	
Flow (gal/ton)	170		460		12		5		51	
C&TT	PSP,SSP, Set.Basin,FDMG		PSP,SSP Set.Basin,FDMG		PSP,CL,CT,RTP96		PSP,FDP,RTP99.7		PSP,TP,RTP93	
	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#	mg/l	#/1000#
Suspended Solids	1	0.00071	1	0.0019	9	0.00045	2	0.000038	18	0.0038
Oil & Grease	12	0.0085	9	0.017	10	0.00050	4	0.00018	10	0.0021
pH (Units)	7.4-7.5		7.4		7.1-7.6		7.6-7.8		7.8-8.1	
Chromium	0.03	0.00002	0.04	0.00008	0.13	Neg.	0.03	Neg.	0.08	0.00002
Copper	0.04	0.00003	0.04	0.00008	0.04	Neg.	0.02	Neg.	0.76	0.00016
Lead	0.05	0.00004	0.05	0.00010	0.05	Neg.	0.05	Neg.	0.32	0.00007
Nickel	0.05	0.00004	0.02	0.00004	0.02	Neg.	0.02	Neg.	0.48	0.00010
Zinc	0.03	0.00002	0.02	0.00004	0.07	Neg.	0.02	Neg.	0.10	0.00002

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(1) Data includes flow from scarfing operations.
(2) Average of all values from Tables VII-2 and VII-3.

Neg.: Negligible. Load is less than 0.00001 #/1000#.

TABLE VII-4

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING-SECTION

RAW WASTEWATERS

Reference Code:	0424 (01-03)		0248A & B		0256K		0432J		0176-04		0176 (01-03)		0684D (02 & 03)		240A (01 & 02)	
Plant Code :	C		H		K		M		O (Rod Mill)		O(Rolling Mills)		Q		R	
Sample Point :	8		13		10		6		10		1		8		4	
Flow (gal/ton):	5260		4210		1470		670		12,860		4970		1780		7950	
	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs
Suspended Solids	3.3	0.86	54	0.95	93	0.57	54	0.15	113	6.060	15	0.31	43	0.32	32	1.061
Oil & Grease	1.9	0.42	9.2	0.16	4.7	0.029	9.9	0.020	0.2	0.011	4.9	0.10	1.5	0.011	3.8	0.13
pH (Units)	3.2-7.0		6.0-6.3		7.2-7.5		6.3-6.5		7.4-7.5		8.3-8.5		7.4-7.6		6.7-6.8	
Chromium	*	*	*	*	*	*	0.07	0.00020	*	*	*	*	0.03	0.00022	*	*
Copper	*	*	*	*	0.05	0.00030	0.04	0.00011	0.01	0.00054	0.08	0.0017	0.03	0.00022	*	*
Lead	0.03	0.00066	0.03	0.00053	0.03	0.00018	NA	NA	0.03	0.0016	0.03	0.00062	0.03	0.00022	0.03	0.00099
Nickel	0.14	0.0031	*	*	0.82	0.00050	0.11	0.00031	0.29	0.16	0.43	0.0089	*	*	0.06	0.0020
Zinc	0.02	0.00044	0.02	0.00035	0.02	0.00012	0.012	0.000034	0.02	0.0011	0.03	0.00062	0.06	0.00045	0.02	0.00066

TREATED EFFLUENT

Reference Code:	0424 (01-03)(1)		0248A & B		0256K		0432J		0176-04(2)		0176 (01-03)(2)		0684D(02 & 03)(1)		240A (01 & 02)	
Plant Code :	C		H		K		M		O		O		Q		R	
Sample Point :	(8÷(8+6+7))1		13		10		6		11		3		(8/4)(5)		8	
Flow (gal/ton):	5260		4210		1470		140		320		270		1780		7950	
C&TT :	PSP,SB(UNK),SS RET84, BD16		PSP,OT		PSP,OT		PSP,SS,RTP80, BD20		SL,PSP,RTP97, BD3		SSP,SS,TP CT,RTP94,BD6		PSP,OT,CNT(45)		PSP,SSP,SL(UNK) OT	
	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs	mg/1	lbs/ 1000 lbs
Suspended Solids	28	0.66	54	0.95	93	0.57	54	0.032	35	0.047	57	0.065	29	0.20	45	1.59
Oil & Grease	5.4	0.058	9.2	0.16	4.7	0.029	9.9	0.0058	0.7	0.00094	12.3	0.014	4.0	0.010	5.3	0.18
pH (Units)	5.0-7.7		6.0-6.3		7.2-7.5		6.3-6.5		7.6-8.1		8.2-8.5		7.2-7.6		7.4-7.5	
Chromium	0.04	0.0	*	*	*	*	0.07	0.000041	0.003	Neg.	*	*	*	*	*	*
Copper	0.03	0.0	*	*	0.05	0.00030	0.04	0.000023	0.01	0.000013	0.04	0.000045	0.02	0.00040	0.01	0.00033
Lead	0.03	0.0	0.03	0.00053	0.03	0.00018	NA	NA	0.03	0.000040	0.03	0.000034	0.03	0.00050	0.03	0.00099
Nickel	0.12	0.0057	*	*	0.82	0.00050	0.11	0.000064	0.32	0.00043	0.44	0.00050	0.63	0.0	0.04	0.0013
Zinc	0.03	0.00015	0.02	0.00035	0.02	0.00012	0.012	Neg.	0.02	0.000027	0.02	0.000023	0.07	0.00094	0.02	0.00066

TABLE VII-4
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING-SECTION
PAGE 2

RAW WASTEWATERS

Reference Code :	0112 B		0291C		0196A (09 & 10)		0384A-06		0640A (01 & 02)		0432A-04		08560			
Plant Code :	A-2		D-2		E-2		F-2		G-2		H-2		I-2			
Sample Point(s):	4		(4+5)		(2+3)		2		1		3		1		Average	
Flow (gal/ton) :	600		6420(3)		4690(3)		1910		14,020		6950		5010		5657	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	103	0.26	41	1.10	60	1.13	41	0.33	68	3.98	96	2.78	185	3.86	69	1.52
Oil & Grease	17.3	0.044	18.5	0.49	15.1	0.28	5.9	0.047	2.7	0.16	18.6	0.54	122	2.54	15.7	0.33
pH (Units)	7.6		8.0-8.1		8.2-8.3		7.7		7.4-8.0		6.6-6.8		7.6-7.7		3.2-8.5	
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.030	0.00036
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.03	0.00069
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.23	0.022
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.025	0.00047

TREATED EFFLUENT

Reference Code:	0112B		0291C		0196A (09 & 10)		0384A-06		0640A(01 & 02)(4)		0432A-04		08560	
Plant Code :	A-2		D-2		E-2		F-2		G-2		H-2		I-2	
Sample Point :	2		6		5		3		2		2		5	
Flow (gal/ton):	360		4490		1640		140		0		6590		5010	
C&TT :	PSP,CL,FDS RTP40, BD60		PSP,T,SS,FD, RTP30, RET70		PSP,CL,FDS,CT, SL,RTP65,BD35		PSP,SSP,SS,CL, FLL,FLP,NW,VF, CT,RTP98,BD2		PSP,SS,SL,FD, CT,RTP100		PSP,CY,OT		PSP,SL,OT	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	1.7	0.0043	23.3	0.44	10.0	0.075	29	0.017	47	Complete	71	1.95	39	0.81
Oil & Grease	1.7	0.0043	8.3	0.16	9.8	0.059	8.3	0.0048	2.3	Recycle Operation	17.8	0.49	14.0	0.29
pH (Units)	7.6-8.0		7.9-8.2		8.3		7.8-8.5		7.4-8.1		6.8-7.0		6.7	
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

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(1) The lbs/1000 lbs value for this operation cannot be derived directly from the concentrations and flow rate shown. See the Section VII text for further explanation.
(2) The effluent sample results shown are for an intermediate sample point. The discharge from the noted treatment components receives additional treatment in a central treatment system.
(3) Flow rate (gallons/ton) is based on 2 turns/day operation.
(4) The analysis for the treated effluent sample for this operation is on the wastewater that is recycled back to the process.

NA : Not Analyzed
ND : Not Detected
Neg.: Value for lbs/1000 lbs calculation is less than 0.00001

*: Value is less than 0.010 mg/l
For the definition of C&TT Codes see Table VII-1

TABLE VII-5

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HOT FORMING-SECTION

RAW WASTEWATERS

Reference Code	0176-(01-03)		0860H-02		0860H-03		0432A-02		0684H-(06&07)		0684H-02		0684H-01	
Plant Code	081-#1&#2 Mills		083-34" Mill		083-Rod Mill		087-14" Mill		088-10"/11" Mill		088-34" Mill		088-36" Mill	
Sample Point(s)	C		G		K		D		T		F		D+F	
Flow (gal/ton)	3570		4720		6930		6340		3400		580		4710	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	14	0.21	35	0.69	259	7.48	62	1.64	52	0.74	20	0.048	22	0.43
Oil & Grease	12	0.18	47	0.93	38	1.10	4	0.11	33	0.47	2	0.0048	2.6	0.052
pH (Units)	7.8-8.1		6.9		7.3-7.5		7.1-7.4		7.3-7.5		7.6-7.8		7.6-8.0	
Chromium	0.035	0.00052	0.11	0.022	0.045	0.0013	0.24	0.0063	0.030	0.00043	0.030	0.000073	0.030	0.00060
Copper	0.60	0.0089	0.090	0.018	0.14	0.0040	0.050	0.0013	0.070	0.00099	0.14	0.00034	0.14	0.0028
Lead	0.22	0.0033	0.050	0.00098	0.050	0.0014	0.79	0.021	0.050	0.00071	0.050	0.00012	0.050	0.00098
Nickel	0.50	0.0074	0.020	0.00039	0.020	0.00058	0.50	0.013	0.090	0.0013	0.055	0.00013	0.045	0.00095
Zinc	0.040	0.00060	0.080	0.0016	0.080	0.0023	0.26	0.0069	0.77	0.011	0.045	0.00011	0.030	0.00058

TREATED EFFLUENT

Reference Code	0176-(01-03)(1)(2)		0860H-02(2)		0860H-03(1)(3)		0432A-02(1)		0684H-(06&07)		0684H-02		0684H-01	
Plant Code	081-#1&#2 Mills		083-34" Mill		083-Rod Mill		087-14" Mill		088-10"/11" Mill		088-34" Mill		088-36" Mill	
Sample Point(s)	(B/B+C)(E)		(G/Q)(B)		R		(D/D+C+E)(F)		S		(F/M)P		(D+E/M)P	
Flow (gal/ton)	250		180		90		6340		10.2		1.7		14	
C&TT	SSP,SS,TP,CT, RTP93,BD7		PSP,CL,CT,T, CNT,RTP96.3,BD3.7		PSP,CL,RTP99, BD1		CNT,CL,FLL, VF,SS,FLM		PSP,SSP,SB,CL,T, VF,FLP,RTP99.7		PSP,FD(UNK),CL, T,VF,RTP99.7		PSP,FD(UNK),CL,T, VF,RTP99.7	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	18	0.014	9	0.00082	62	0.023	38	1.05	19	0.00081	2	0.000012	2	0.000090
Oil & Grease	10	0.0024	10	0.015	30	0.011	4	0.079	16	0.00068	4	0.000033	4	0.00016
pH (Units)	7.8-8.1		7.1-7.6		7.4		7.4-7.6		8.5-9.5		7.6-7.8		7.6-7.8	
Chromium	0.080	0.000048	0.13	0.000015	0.030	0.000011	0.043	0.0025	0.030	Neg.	0.030	Neg.	0.030	Neg.
Copper	0.76	0.00064	0.045	0.000016	0.070	0.000026	0.031	0.00040	0.020	Neg.	0.020	Neg.	0.020	Neg.
Lead	0.32	0.00020	0.050	Neg.	0.050	0.000019	+	+	0.050	Neg.	0.050	Neg.	0.050	Neg.
Nickel	0.48	0.00047	0.020	Neg.	0.020	Neg.	+	+	0.025	Neg.	0.020	Neg.	0.020	Neg.
Zinc	0.10	0.000062	0.070	0.000021	0.055	0.000021	0.21	0.0093	0.050	Neg.	0.020	Neg.	0.020	Neg.

TABLE VII-5
SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HOT FORMING-SECTION
PAGE 2

RAW WASTEWATERS

Reference Code	0684H-03		0684H-05		0176-04					
Plant Code	088-32" Mill		088-14" Mill		081-No.4 Mill					
Sample Point(s)	G		W+Y		F		Average		Overall Average(4)	
Flow (gal/ton)	930		4800		8230		4420		5160	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	31	0.12	80	1.61	84	2.88	65.9	1.58	67.8	1.54
Oil & Grease	12	0.047	68	1.38	253	8.68	47.2	1.30	28.3	0.72
pH (Units)	7.7-7.9		7.0-7.5		7.1-7.3		6.9-8.1		3.2-8.5	
Chromium	0.030	0.00012	0.030	0.00061	0.090	0.0031	0.067	0.0035	*	*
Copper	0.080	0.00031	0.075	0.0015	0.13	0.0045	0.15	0.0043	0.076	0.0020
Lead	0.050	0.00019	0.066	0.0013	0.050	0.0017	0.14	0.0041	0.073	0.0020
Nickel	0.055	0.00021	0.18	0.0037	0.83	0.028	0.23	0.0057	0.23	0.010
Zinc	0.055	0.00021	1.23	0.025	0.085	0.0029	0.27	0.0051	0.13	0.0024

TREATED EFFLUENT

Reference Code	0684H-03		0684H-05		0176-04(2)	
Plant Code	088-32" Mill		088-14" Mill		081-No.4 Mill	
Sample Point(s)	(G/M)(P)		AC		G	
Flow (gal/ton)	2.8		10		340	
C&TT	PSP,FD(UNK),CL,T, VF,RTP99.7		PSP,CT,CL,RUP44 RTP55.7,BD0.3		SL,RTP96,BD4	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	2	0.000025	87	0.0036	23	0.033
Oil & Grease	4	0.00018	15	0.00063	8	0.011
pH (Units)	7.6-7.8		7.5		7.7-7.9	
Chromium	0.030	Neg.	0.12	Neg.	0.070	0.000099
Copper	0.020	Neg.	0.27	0.000011	0.075	0.00011
Lead	0.050	Neg.	0.095	Neg.	0.050	0.000091
Nickel	0.020	Neg.	0.47	0.000020	0.49	0.00069
Zinc	0.020	Neg.	2.2	0.000092	0.045	0.000064

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(1) The lbs/1000 lbs value for this operation cannot be derived directly from the concentrations and flow rate shown. See the Section VII text for further explanation.

(2) The effluent sample results shown are for an intermediate sample point. The discharge from the noted treatment components receives additional treatment in a central system.

(3) Plant 083 (Rod Mill) eventually achieves a discharge flow rate of 3.5 gal/ton by recycling additional wastewater from a large central treatment system. The effluent sample results shown are for an intermediate sample point.

(4) Average of all values on Tables VII-4 and VII-5.

NA: Not Analyzed
ND: Not Detected

Neg.: Value for lbs/1000 lbs calculations is less than 0.00001
For the definition of C&TT codes see Table VII-1

TABLE VII-6

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING-FLAT: HOT STRIP AND SHEET

RAW WASTEWATERS

Reference Code:	0248B		0020B		0176		0860B		0060		0384A		0396D			
Plant Code:	D		E		O		J-2		L-2		M-2		N-2			
Sample Point(s):	#6		#7		#10		#1+#3+#4		#1		#2+#3		#6		Average	
Flow (gal/ton):	3310		4520		12,800		7850		4520		8440		7270		6960	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	57	0.79	42	0.79	113	6.03	16.6	0.54	16	0.30	25	0.88	54	1.64	46	1.57
Oil & Grease	19.2	0.27	15.3	0.29	0.2	0.011	6.8	0.22	12.1	0.23	6.4	0.22	31	0.94	13	0.31
pH (Units)	6.3		5.9-6.1		7.4-7.5		7.3-8.3		7.6-8.1		8.4		7.3-7.5		5.9-8.4	
Chromium	*	*	*	*	*	*	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Copper	*	*	*	*	0.01	0.00053	NA	NA	NA	NA	NA	NA	NA	NA	*	*
Lead	NA	NA	0.03	0.00057	0.03	0.0016	NA	NA	NA	NA	NA	NA	NA	NA	0.03	0.0011
Nickel	0.13	0.0018	*	*	0.29	0.015	NA	NA	NA	NA	NA	NA	NA	NA	0.14	0.060
Zinc	0.02	0.00028	0.07	0.0013	0.02	0.0011	NA	NA	NA	NA	NA	NA	NA	NA	0.04	0.00089

TREATED EFFLUENT

Reference Code:	0248B		0020B(1)		0176		0860B		0060		0384A		0396D	
Plant Code:	D		E		O		J-2		L-2		M-2		N-2	
Sample Point(s):	#6		$(\frac{\#7}{\#6+\#7})\#5$		#11		#2+#3+#4		#2		#4		#7	
Flow (gal/ton):	3310		4520		320		7850		76		8440		0	
C&TT:	PSP,OT		PSP,CL,FDBS,OT		PSP,RUP-97.5, BD-2.5		PSP,SSP,FLP, Filter,CL,VF,OT		PSP,FLL,FLO1, CL,VF,CT, RTP-98.3,BD-1.7		PSP,CL, VF,OT		PSP,CT,VF,CL, F(UNK)S(UNK), RTP-100	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	57	0.79	13	0.18	35	0.047	8.1	0.26	5	0.0016	16	0.56	39	0
Oil & Grease	19.2	0.27	2.0	0.030	0.7	0.00093	5.7	0.19	7.9	0.0025	6.9	0.24	61	0
pH (Units)	6.3		5.8-6.6		7.6-8.1		7.7-8.3		8.6-8.7		8.4-8.5		7.4-7.7	
Chromium	*	*	*	*	0.003	0.000004	NA	NA	NA	NA	NA	NA	NA	0
Copper	*	*	*	*	0.09	0.00012	NA	NA	NA	NA	NA	NA	NA	0
Lead	NA	NA	*	*	0.03	0.000040	NA	NA	NA	NA	NA	NA	NA	0
Nickel	0.13	0.0018	*	*	0.32	0.00043	NA	NA	NA	NA	NA	NA	NA	0
Zinc	0.02	0.00028	0.03	0.00065	0.02	0.000027	NA	NA	NA	NA	NA	NA	NA	0

---

(1) The lbs/1000 lbs values for this operation cannot be derived directly from the concentration and flow rate values. See the Section VII text for further explanation.
* : Concentration is less than 0.01 mg/l.
FLO1: Flocculation with ferric sulfate

NOTE: For definition of remaining C&TT codes, see Table VII-1.

TABLE VII-7

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HOT FORMING FLAT: HOT STRIP & SHEET

RAW WASTEWATERS

					Average		Overall Average(3)	
Reference Code:	0112D-02(1)		0432A					
Plant Code:	086		087					
Sample Point(s):	B		C					
Flow, (gal/ton):	5790		4800		5300		6590	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	46	1.11	57	1.14	52	1.13	47	1.47
Oil & Grease	10	0.24	6	0.12	8	0.18	12	0.28
pH (Units)	8.0-8.1		7.4-7.6		7.4-8.1		5.9-8.4	
Chromium	0.03	0.00072	0.170	0.0034	0.100	0.0024	+	+
Copper	0.025	0.00060	0.045	0.00090	0.035	0.00075	+	+
Lead	0.05	0.0012	+	+	0.05	0.0012	0.06	0.0011
Nickel	0.02	0.00048	+	+	0.02	0.00048	0.15	0.0058
Zinc	0.025	0.00060	0.200	0.0040	0.112	0.0023	0.067	0.0015

TREATED EFFLUENT

Reference Code:	0112D-02(2)		0432A(2)	
Plant Code:	086		087	
Sample Point(s):	(F+C+I+E)D		$(\frac{C}{C+D+E})F$	
Flow, (gal/ton):	5790		4800	
C&TT:	PSP,SS,CL,FLP,NL,NW, CR,SL(UNK),OT		FLP,FLM,CL,SS,SCR,VF, OT	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	4	0.061	38	0.73
Oil & Grease	2	0.020	4	0.088
pH (Units)	7.6-7.9		7.4-7.6	
Chromium	0.03	0.00018	0.174	0.0030
Copper	0.02	0.00014	0.031	0.00057
Lead	0.05	0.00019	+	+
Nickel	0.02	0.00044	+	+
Zinc	0.04	0.00028	0.206	0.0037

---

(1) Applied and discharge flows do not include the flow from the scale pit to flume flushing. This recycle loop was inaccessible for flow measurements during the time of sampling.
(2) The lbs/1000 lbs values for this operation cannot be derived directly from the concentration and flow rate values. See the Section VII text for further explanation.
(3) Average of all values in Tables VII-6 and VII-7.

+ : Cannot be evaluated
NOTE: For definition of remaining C&TT codes, see Table VII-1.

TABLE VII-8

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT FORMING-FLAT: PLATE

RAW WASTEWATERS

Reference Code:	0856H		0868B			
Plant Code:	F		K-2			
Sample Point(s):	#7-#9		#1		Average	
Flow (gal/ton):	4290		3690		3990	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	269	4.81	61	0.94	165	2.88
Oil & Grease	128	2.29	10.9	0.17	69.4	1.23
pH (Units)	6.3-6.5		6.9-7.2		6.3-7.2	
Chromium	0.01	0.00018	NA	NA	0.01	0.00018
Copper	*	*	NA	NA	*	*
Lead	0.03	0.00036	NA	NA	0.03	0.00036
Nickel	1.2	0.021	NA	NA	1.2	0.021
Zinc	0.07	0.0012	NA	NA	0.07	0.0012

TREATED EFFLUENT

Reference Code:	0856H		0868B	
Plant Code:	F		K-2	
Sample Point(s):	#8		#2	
Flow (gal/ton):	4290		100	
C&TT:	PSP,OT		PSP,SSP,T,Filter,CT, RTP97.3,BD2.7	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	104	1.86	5.3	0.0022
Oil & Grease	79	1.41	6.3	0.0026
pH (Units)	6.6-6.7		7.0-7.3	
Chromium	*	*	NA	NA
Copper	*	*	NA	NA
Lead	*	*	NA	NA
Nickel	0.08	0.0014	NA	NA
Zinc	0.05	0.00089	NA	NA

---

* : Concentration is less than 0.01 mg/l.

NOTE: Explanation of C&TT abbreviations is presented in Table VII-1.

TABLE VII-9

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT STUDY
HOT FORMING-FLAT: PLATE

RAW WASTEWATERS

Reference Code:	0496-01$^{(1)}$		0496-01$^{(1)}$		0496-02$^{(1)}$		0496-03&04$^{(1)}$		0496-03&04$^{(1)}$		0860H-01		0112D-01					
Plant Code:	.082(140" Carbon)		082(140" Specialty)		082(140"/ 206")		082(112"/120" Carbon)		082(112"/120" Specialty)		083		086					
Sample Point(s):	H-A		G-A		J-2-A		D-A		C-A		I		H		Average		Overall Average$^{(2)}$	
Flow, (gal/ton):	120		870		210		870		2650		9790		3240		2540		2860	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	67	0.43	111	0.61	50	0.52	24	0.15	33	0.58	21	0.86	35	0.47	49	0.52	75	1.04
Oil & Grease	46	0.35	72	0.41	16	0.38	20	0.13	18	0.32	20	0.82	18	0.24	30	0.38	39	0.57
pH (Units)	7.7-8.9		7.8		7.7		7.2		7.5		7.2-7.3		8.0-8.2		7.2-8.9		6.3-8.9	
Chromium	0.06	0.0011	0.07	0.0019	0.04	0.0015	0.03	0.00019	0.03	0.00053	0.12	0.0049	0.03	0.00041	0.05	0.0015	0.04	0.0013
Copper	0.16	0.0022	0.22	0.0028	0.33	0.0025	0.22	0.0014	0.21	0.0037	0.10	0.0041	0.06	0.00081	0.19	0.0025	0.19	0.0025
Lead	0.26	0.0010	0.47	0.0015	0.05	0.00050	0.06	0.00038	0.06	0.0011	0.05	0.0020	0.05	0.00068	0.14	0.0010	0.13	0.00092
Nickel	0.37	0.00080	0.98	0.0020	0.16	0.0014	0.15	0.00096	0.15	0.0026	0.03	0.0012	0.06	0.00081	0.27	0.0014	0.39	0.0039
Zinc	0.08	0.00031	0.09	0.0026	0.10	0.0020	0.09	0.00057	0.09	0.0016	0.11	0.0045	0.03	0.00041	0.08	0.0018	0.08	0.0017

TREATED EFFLUENT

Reference Code:	0496-01$^{(1)}$		0496-01$^{(1)}$		0496-02$^{(1)}$		0496-03&04$^{(1)}$		0496-03&04$^{(1)}$		0860H-01$^{(1)}$		0112D-01$^{(1)}$	
Plant Code:	082(140" Carbon)		082(140" Specialty)		082(140"/ 206")		082(112"/120" Carbon)		082(112"/120" Specialty)		083		086	
Sample Point(s):	$(\frac{H}{H+D+J-1})(P-A)$		$(\frac{G}{G+C+J-1})(O-A)$		$(\frac{J-2}{J-2+H+D})(P-A)$		$(\frac{D}{D+H+J-1})(P-A)$		$(\frac{C}{C+G+J-1})(O-A)$		$(\frac{I}{Q})B$		$(\frac{H}{F+G+I+E})D$	
Flow, (gal/ton):	120		870		210		870		2650		360		3240	
C&TT:	PSP,SSP,DR, FDMC,OT		PSP,SSP,DR FDMC,OT		PSP,SSP,DR, FDMC,OT		PSP,SSP,DR, FDMC,OT		PSP,SSP,DR FDMC,OT		PSP,CL,CT, RTP96.3,BD3.7		PSP,CL,FLP SL(UNK),OT	
	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs	mg/l	lbs/ 1000 lbs
Suspended Solids	1	0.00088	1	0.0085	1	0.0021	1	0.0064	1	0.018	9	0.00011	4	0.026
Oil & Grease	10	0.0088	13	0.076	10	0.018	10	0.064	13	0.23	10	0.0014	2	0.021
pH (Units)	7.4		7.5		7.4		7.4		7.5		7.1-7.6		7.6-7.9	
Chromium	1	0.00011	0.03	0.00023	1	0.0021	1	0.0064	0.03	0.00053	0.13	Neg.	0.03	0.000096
Copper	0.04	0.000089	0.05	0.00034	0.04	0.00010	0.04	0.00026	0.05	0.00088	0.04	Neg.	0.02	0.00018
Lead	0.04	0.000089	0.05	0.00034	0.04	0.00010	0.04	0.00026	0.05	0.00088	0.05	Neg.	0.05	0.00021
Nickel	0.04	0.000089	0.04	0.00027	0.04	0.00010	0.04	0.00026	0.04	0.00071	0.02	Neg.	0.02	0.00073
Zinc	0.03	0.000038	0.02	0.00018	0.03	0.000006	0.03	0.00019	0.02	0.00035	0.07	Neg.	0.04	0.00019

---

(1) The lbs/1000 lbs values for this operation cannot be derived directly from the concentrations and flow rates shown. See the Section VII text for further explanation.

(2) Average of all values in Tables VII-8 and VII-9.

NOTE: For definition of C&TT codes, see Table VII-1.

TABLE VII-10

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
ORIGINAL GUIDELINES STUDY
HOT WORKING PIPE AND TUBE

RAW WASTEWATERS

Reference Code :	0196A		0240B		0916A(1)		0728		0256G			
Plant Code :	E-2		GG-2		II-2		JJ-2		KK-2		Average	
Sample Point(s):	1		1		1-5		2		1			
Flow (gal/ton) :	12,800		1,700		2,760		2,290		520		4,010	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	39	2.08	44	0.31	202	2.97	123	1.18	117	0.25	105	1.36
Oil and Grease	20	1.07	8.3	0.059	4.3	0.066	11.4	0.11	6.7	0.014	10.1	0.26
pH (Units)	8.2		7.0-7.8		7.0		6.8-6.9		6.8-7.1		6.8-8.2	
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TREATED EFFLUENTS

Reference Code :	0196A(1)		0240B		0916A(1)		0728		0256G	
Plant Code :	E-2		GG-2		II-2		JJ-2		KK-2	
Sample Point(s):	(1/1+2+3)5		-		(1-5/1)4		-		2	
Flow (gal/ton) :	4,570		-		2,760		-		520	
C&TT:	CNT2-32.9,PSP,SS, SSP,SS,SL(UNK),CL, FDSP,CT,RTP-64.3		PSP,Oil Separator, SL(UNK)		PSP,SS,FD(UNK)P, SL(UNK)		PSP,SL(UNK),RTP and RET-100		PSP,SS,SSP	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	10	0.14			34	0.50			116	0.25
Oil and Grease	9.8	0.22			2.0	0.026			7	0.015
pH (Units)	8.3		Complete		7.7		Complete .		6.8-7.4	
Chromium	NA	NA	Recycle		NA	NA	Recycle		NA	NA
Copper	NA	NA			NA	NA			NA	NA
Lead	NA	NA	Operation		NA	NA	and Reuse		NA	NA
Nickel	NA	NA			NA	NA			NA	NA
Zinc	NA	NA			NA	NA	Operation		NA	NA

---

(1) The lbs/1000 lbs values for this operation cannot be derived directly from the concentrations and flow rates shown. See the Section VII text for further explanation.

NA : Not Analyzed

NOTE: For definition of C&TT codes, see Table VII-1.

TABLE VII-11

SUMMARY OF ANALYTICAL DATA FROM SAMPLED PLANTS
TOXIC POLLUTANT SURVEY
HOT WORKING PIPE AND TUBE

RAW WASTEWATERS

Reference Code	0432A		0684H(1)					
Plant Code	087		088					
Sample Point(s)	E		I+J+K+L		Average		Overall Average(4)	
Flow (gal/ton)	8,080		7,010		7,540		5,020	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	66	2.22	35	1.01	50	1.62	89	1.43
Oil and Grease	5	0.17	7.9	0.23	6.5	0.20	9.1	0.25
pH (Units)	7.1-7.4		7.2-7.8		7.1-7.8		6.8-8.2	
Chromium	0.24	0.0081	0.03	0.00092	0.14	0.0045	0.14	0.0045
Copper	0.065	0.0022	0.08	0.0023	0.07	0.0022	0.07	0.0022
Lead	0.80	0.027	0.06	0.0018	0.43	0.014	0.43	0.014
Nickel	0.50	0.017	0.09	0.0026	0.30	0.0098	0.30	0.0098
Zinc	0.25	0.0084	0.06	0.0017	0.16	0.0050	0.16	0.0050

TREATED EFFLUENTS

Reference Code	0432A(2)		0684H(3)	
Plant Code	087		088	
Sample Point(s)	(E/E+C+D)F		(I+J+K+L/M)P	
Flow (gal/ton)	8,080		21	
C&TT	CNT2-11.6, FLP, FLM, CL, SS, SCR, VF		CNT2-8.9, FDSP, VF, FLL, FLP, CT, CL, T, RTP99.7	
	mg/l	lbs/1000 lbs	mg/l	lbs/1000 lbs
Suspended Solids	38	1.42	2	0.00021
Oil and Grease	4	0.13	4	0.00087
pH (Units)	7.4-7.6		7.6-7.8	
Chromium	0.043	0.0032	0.03	Neg.
Copper	0.031	0.014	0.02	Neg.
Lead	*	*	0.05	Neg.
Nickel	*	*	0.02	Neg.
Zinc	0.21	0.011	0.02	Neg.

---

(1) The mg/l values expressed for this operation represent the concentrations which would be present in the combined wastewaters.

(2) The lbs/1000 lbs values for this operation cannot be derived directly from the concentrations and flow rates shown. See the Section VII text for further explanation.

(3) The mg/l values presented for this operation represent the filters' effluent quality.

(4) Average of all values in Tables VII-10 and VII-11.

* : Cannot be evaluated

NOTE: For definition of C&TT codes see Table VII-1.

TABLE VII-12

SUMMARY OF LONG-TERM DATA
HOT FORMING SUBCATEGORY

Plant Code	Total Suspended Solids (mg/l) No. of Observations	Average	Maximum	Standard Deviation	Oil and Grease (mg/l) No. of Observations	Average	Maximum	Standard Deviation	Principle Treatment Component
0112B	87	10.6	24.4	3.9	87	1.1	3.8	0.6	Filtration
0112C-011	580	8.9	44.0	7.0	690	6.7	47.1	6.5	Filtration
0112C-122	496	13.3	63.4	12.4	684	2.0	20.3	2.2	Filtration
0112C-334	415	2.3	23.5	3.0	727	1.3	12.2	1.4	Filtration
0112C-617	399	4.8	33.8	5.5	647	1.3	7.9	1.3	Filtration
0684H	40	6.0	21.0	5.5	27	3.4	20.0	4.0	Filtration
0684F	78	22.2	60.0	13.7	79	9.6	27.0	4.3	Filtration, Lagoon
0320	151	15.8	39.0	7.4	35	0.1	0.3	0.06	Lagoons
0584A	101	25.4	55.0	9.1	98	5.9	20.6	4.3	Settling Basin
0584B	98	24.6	50.0	8.6	58	8.4	29.0	4.2	Lagoons
0856N	101	32.1	114.0	21.6	103	7.0	20.3	2.7	Settling Basin

NOTE: Additional details on long-term data analysis are provided in Volume I.

TABLE VII-13

D-DCP SCALE AND OILS GENERATION DATA
HOT FORMING SUBCATEGORY

		Suspended Solids		Oils and Greases
Subcategory	Plant Code	Pounds of Scale Per Ton of Production	% of Production	Gallons of oils Per Ton of Production
Primary	0868A	50-75	2.5-3.75	0.14
	0320	47	2.35	NA
	0864A	47	2.35	0.126
	0432J	23	1.15	0.15
	0920A	42	2.1	0.0025(2)
	0460A	36	1.8	0.010(2)
	0440A	41	2.05	Negligible
	0112B	NA	NA	NA
Section	0068B	60	3.0	NA
	0136B	40	2.0	NA
	0088A	30	1.5	NA
	0136B	NA	NA	NA
	0672B	50	2.5	0(2)
	0672B	50	2.5	0(2)
	0684H	26	1.3	NA
	0860H	20	1.0	0.45
	0612	36	1.8	Unknown
Flat	0060	20	1.0	NA
	0176	NA	NA	NA
	0432C	23	1.15	0.01(2)
	0448A	46	2.3	0.22
	0448A	NA	NA	-
	0684B	12(1)	0.6(1)	NA
	0684F	16.8(1)	0.84(1)	Unknown
	0684V	2(1)	0.05(1)	NA
	0920N	32	1.6	NA
Pipe & Tube	0240B	40	2.0	0.05(2)
	0652A	50	2.6	0.01(2)
	0728	82	4.1	NA
AVERAGE		41.1(1)	2.05%(1) Say: 2.1%	0.23(2)

Summary:

Suspended Solids

Mills without scarfers: 2.1%, 42 lbs/ton
Mills with scarfers : 4.2%, 84 lbs/ton

Oils and Greases

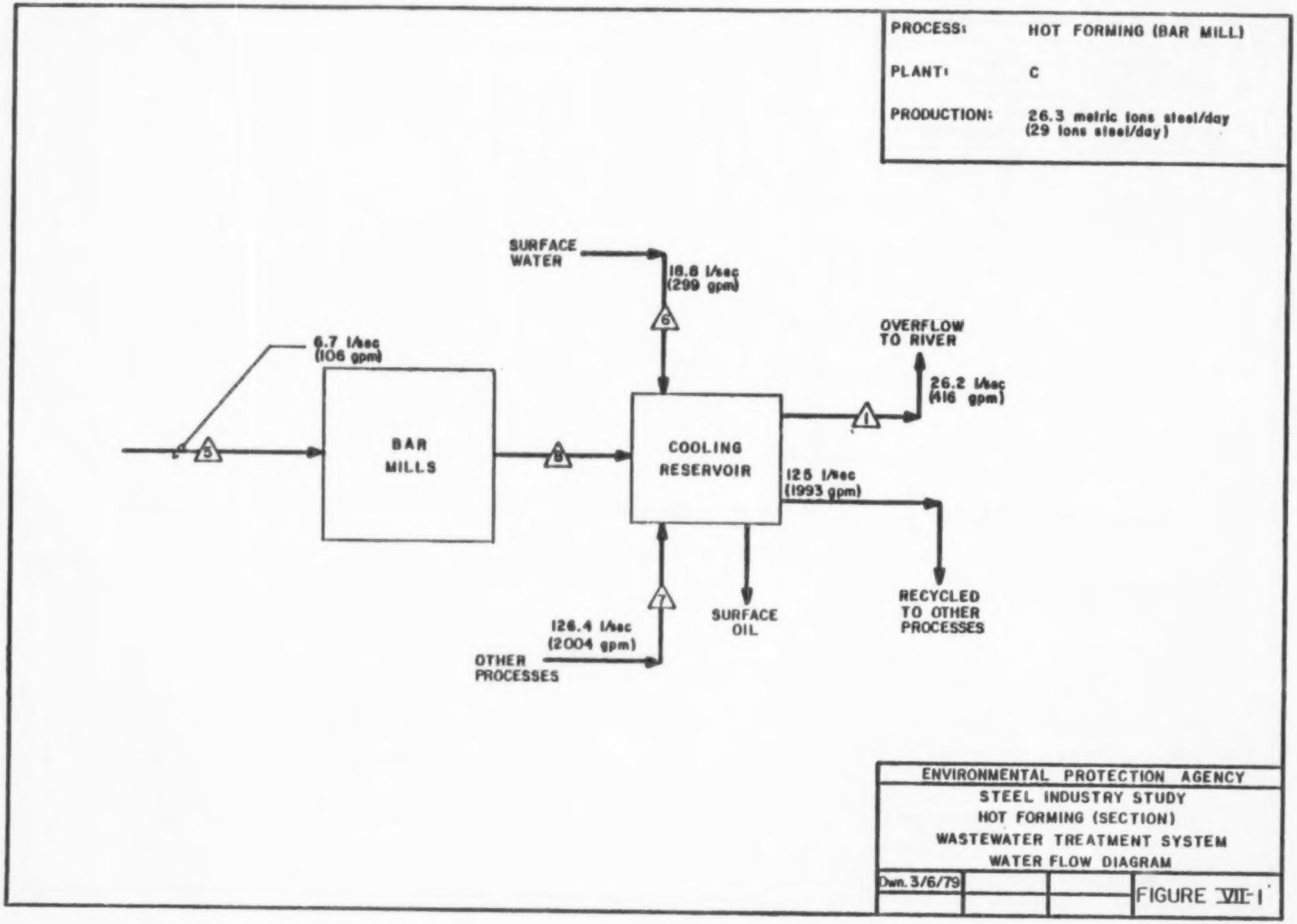
Based on oils with densities 85% that of water
0.23 gal/ton, 1.6 lb/ton

---

(1) The data from those mills reporting a solids generation rate less than 1% (less than 20 lb/ton) were not included in the average as these values were considered to be atypically low.

(2) The oil generation values less than 0.1 gal/ton were not included in the average as these values were considered to be atypically low.

NA: Not Available.


PROCESS: HOT FORMING (BAR MILL)
PLANT: C
PRODUCTION: 26.3 metric tons steel/day (29 tons steel/day)
SURFACE WATER
18.8 l/sec (299 gpm)
6
6.7 l/sec (106 gpm)
5
BAR MILLS
8
COOLING RESERVOIR
OVERFLOW TO RIVER
1
26.2 l/sec (416 gpm)
125 l/sec (1993 gpm)
RECYCLED TO OTHER PROCESSES
SURFACE OIL
7
126.4 l/sec (2004 gpm)
OTHER PROCESSES
Dwn. 3/6/79

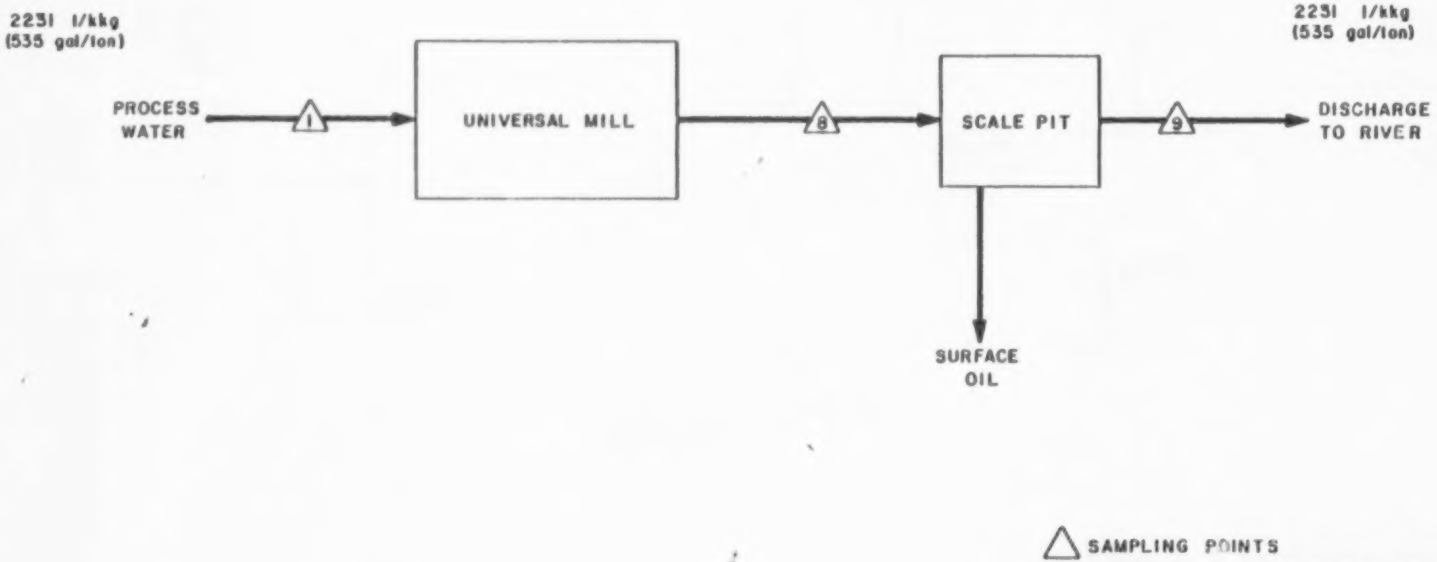
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (SECTION)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-1

PROCESS: Hot Forming - Universal Mill

PLANT: D

PRODUCTION:


2231 l/kkg
(535 gal/ton)
PROCESS WATER
1
UNIVERSAL MILL
8
SCALE PIT
9
SURFACE OIL
2231 l/kkg
(535 gal/ton)
DISCHARGE TO RIVER
SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING - PRIMARY
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

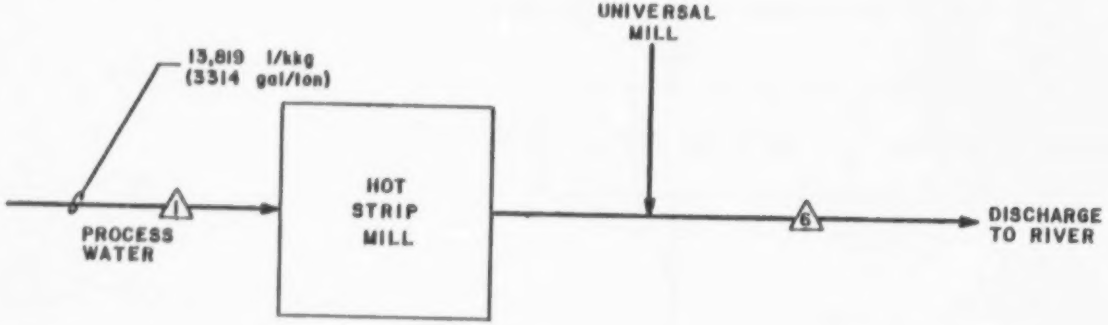
Dwn. 3/2/79

FIGURE VII-2

PROCESS: HOT FORMING (HOT STRIP)

PLANT: D

PRODUCTION:

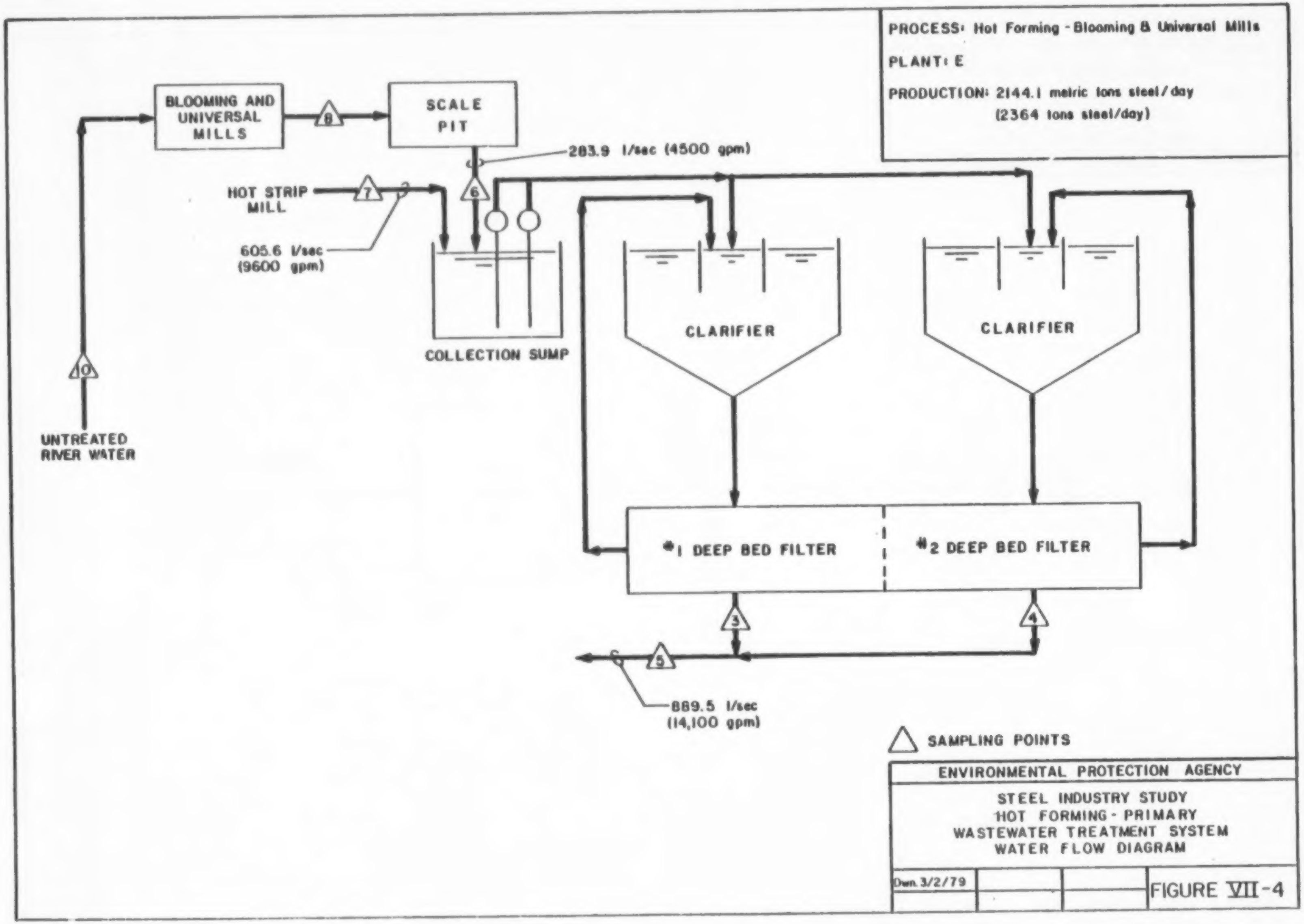

13,819 l/kkg
(3314 gal/ton)
PROCESS WATER
1
HOT STRIP MILL
UNIVERSAL MILL
6
DISCHARGE TO RIVER

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING (FLAT)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn 3/23/79

FIGURE VII-3


BLOOMING AND UNIVERSAL MILLS
8
SCALE PIT
283.9 l/sec (4500 gpm)
HOT STRIP MILL
7
6
605.6 l/sec (9600 gpm)
COLLECTION SUMP
10
UNTREATED RIVER WATER
CLARIFIER
CLARIFIER
#1 DEEP BED FILTER
#2 DEEP BED FILTER
3
4
5
889.5 l/sec (14,100 gpm)
SAMPLING POINTS

PROCESS: Hot Forming - Blooming & Universal Mills

PLANT: E

PRODUCTION: 2144.1 metric tons steel/day
(2364 tons steel/day)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING - PRIMARY
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

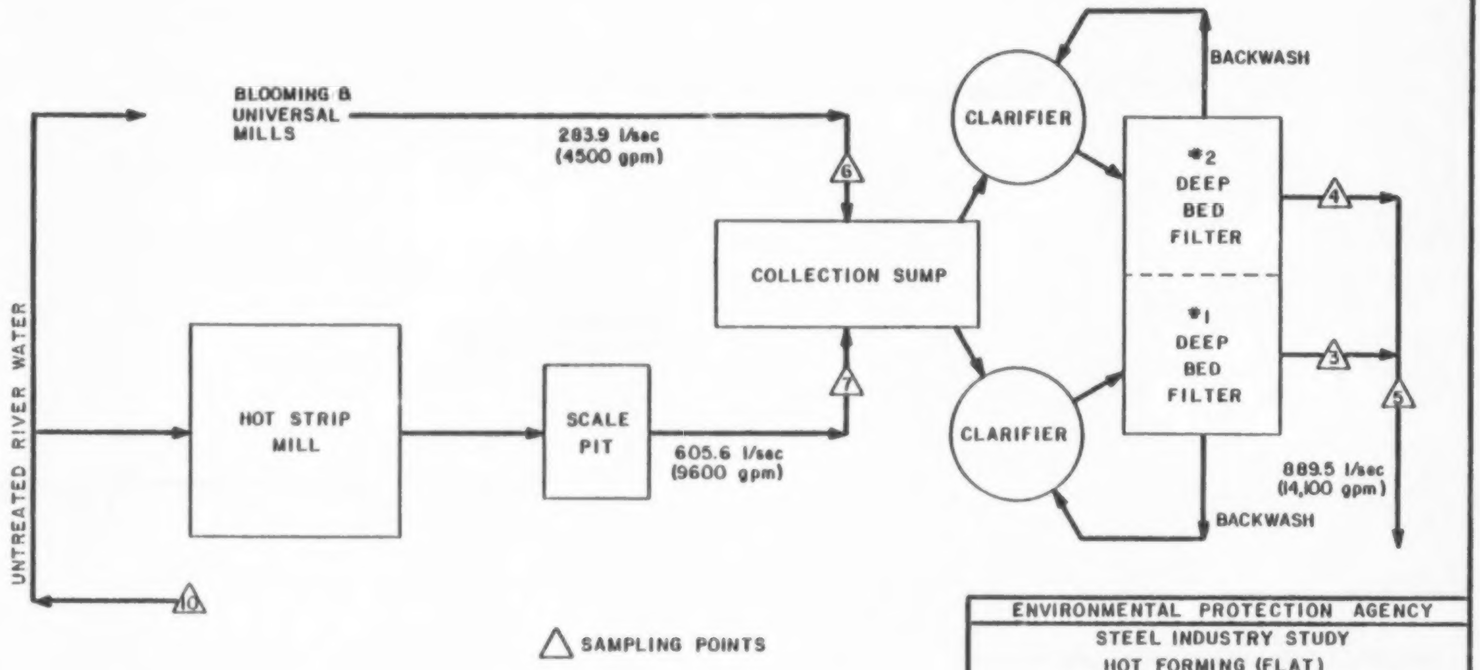
Dwn. 3/2/79

FIGURE VII-4

PROCESS: HOT FORMING - HOT STRIP MILL

PLANT: E

PRODUCTION: 1851.1 METRIC TONS STEEL/DAY
(2041 TONS STEEL/DAY)


UNTREATED RIVER WATER
BLOOMING & UNIVERSAL MILLS
283.9 l/sec (4500 gpm)
HOT STRIP MILL
SCALE PIT
605.6 l/sec (9600 gpm)
6
7
10
COLLECTION SUMP
CLARIFIER
CLARIFIER
BACKWASH
*2 DEEP BED FILTER
*1 DEEP BED FILTER
BACKWASH
4
3
5
889.5 l/sec (14,100 gpm)
SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (FLAT)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

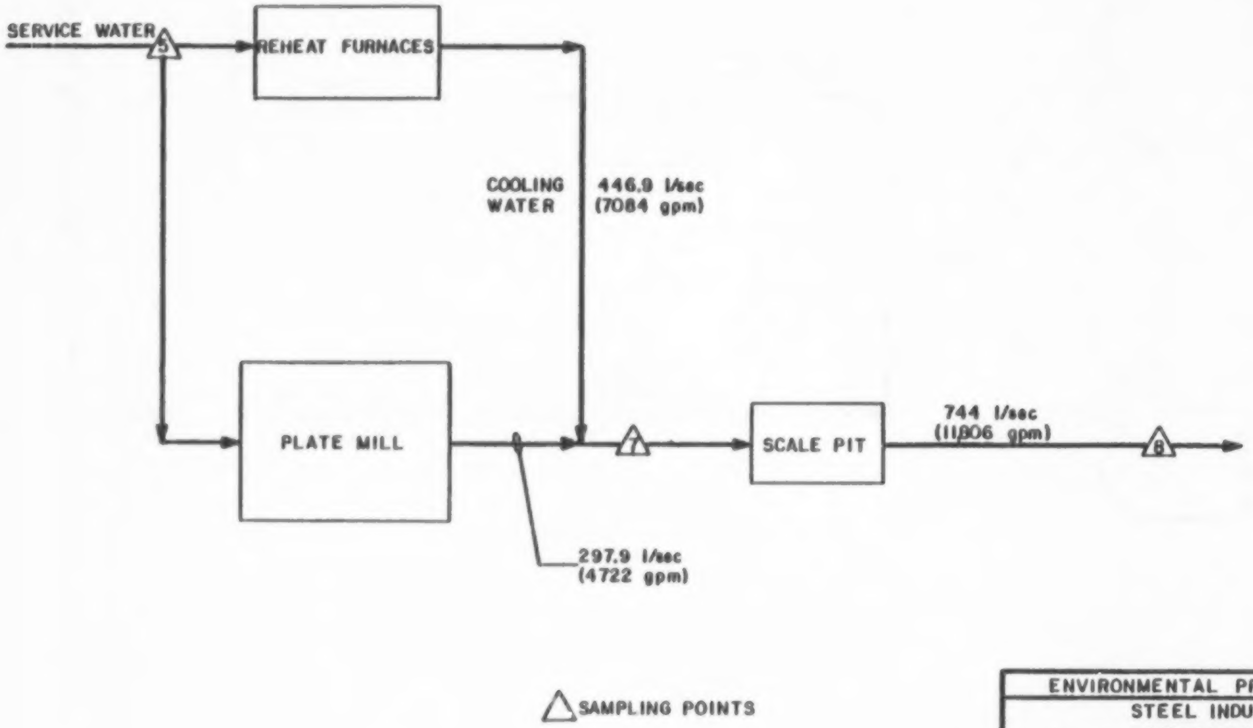
Dwn.3/23/79

FIGURE VII-5

PROCESS: HOT FORMING - PLATE MILL

PLANT: F

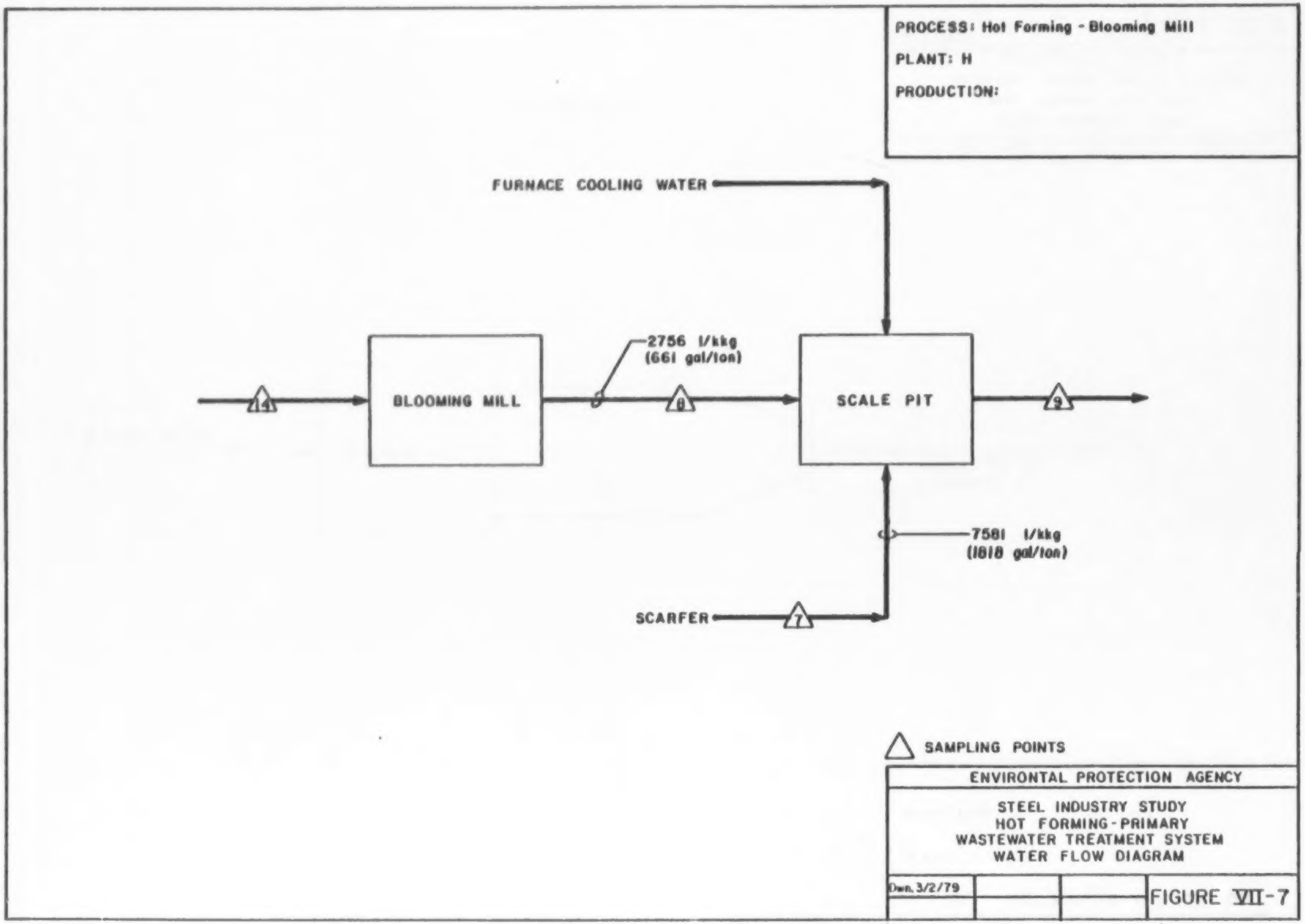
PRODUCTION: 478.9 METRIC TONS STEEL/DAY
(528 TONS STEEL/DAY)


SERVICE WATER
5
REHEAT FURNACES
COOLING WATER
446.9 l/sec
(7084 gpm)
PLATE MILL
297.9 l/sec
(4722 gpm)
7
SCALE PIT
744 l/sec
(11806 gpm)
8
SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (FLAT)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/23/79

FIGURE VII-6


FURNACE COOLING WATER
14
BLOOMING MILL
2756 l/kkg
(661 gal/ton)
8
SCALE PIT
9
7581 l/kkg
(1818 gal/ton)
SCARFER
7
SAMPLING POINTS
Dwn. 3/2/79

PROCESS: Hot Forming - Blooming Mill

PLANT: H

PRODUCTION:

ENVIRONTAL PROTECTION AGENCY

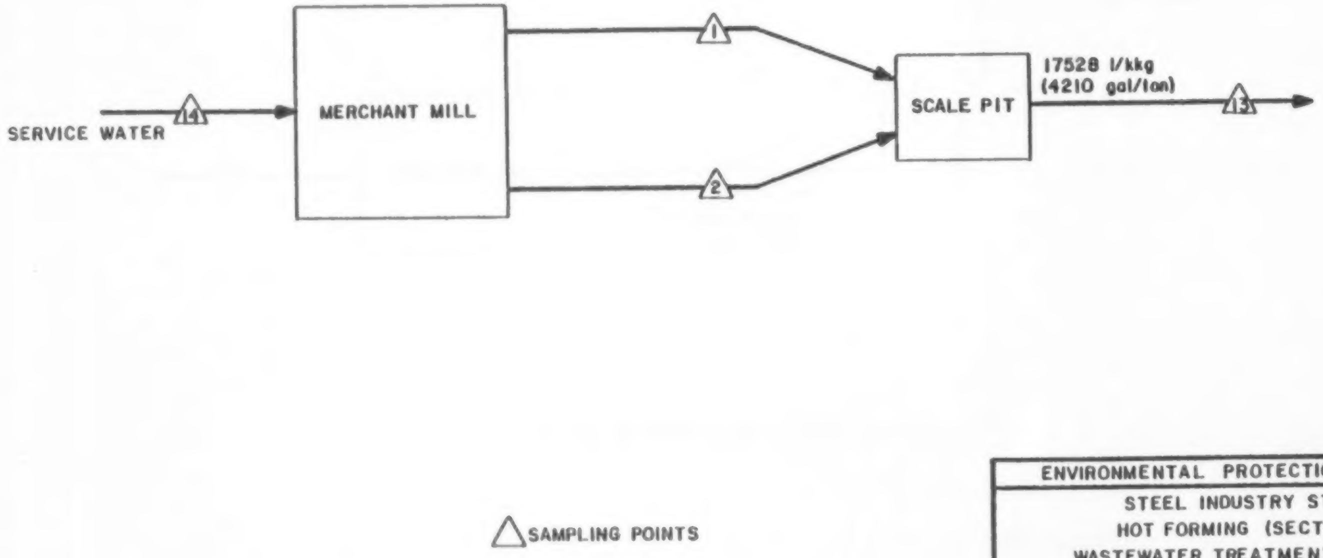
STEEL INDUSTRY STUDY
HOT FORMING-PRIMARY
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-7

PROCESS: HOT FORMING - MERCHANT MILL

PLANT: H

PRODUCTION:


SERVICE WATER
14
MERCHANT MILL
1
2
SCALE PIT
17528 l/kkg
(4210 gal/ton)
13
SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING (SECTION)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

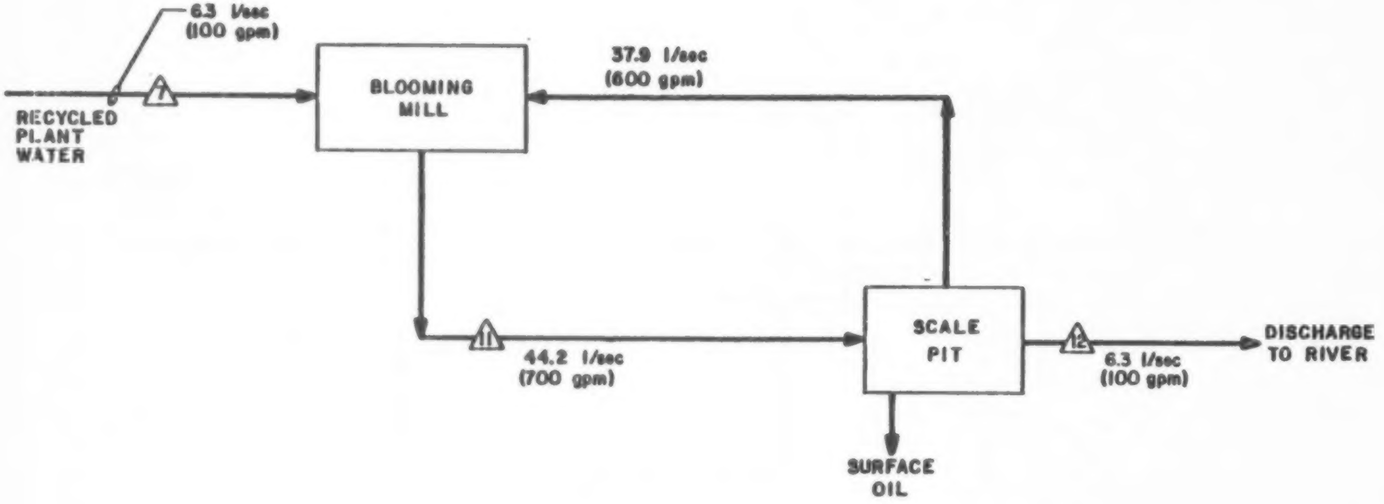
Dwn. 3/6/79

FIGURE VII-8

PROCESS: HOT FORMING (BLOOMING MILL)

PLANT: K

PRODUCTION 163.3 metric tons steel/day
(180 tons steel/day)

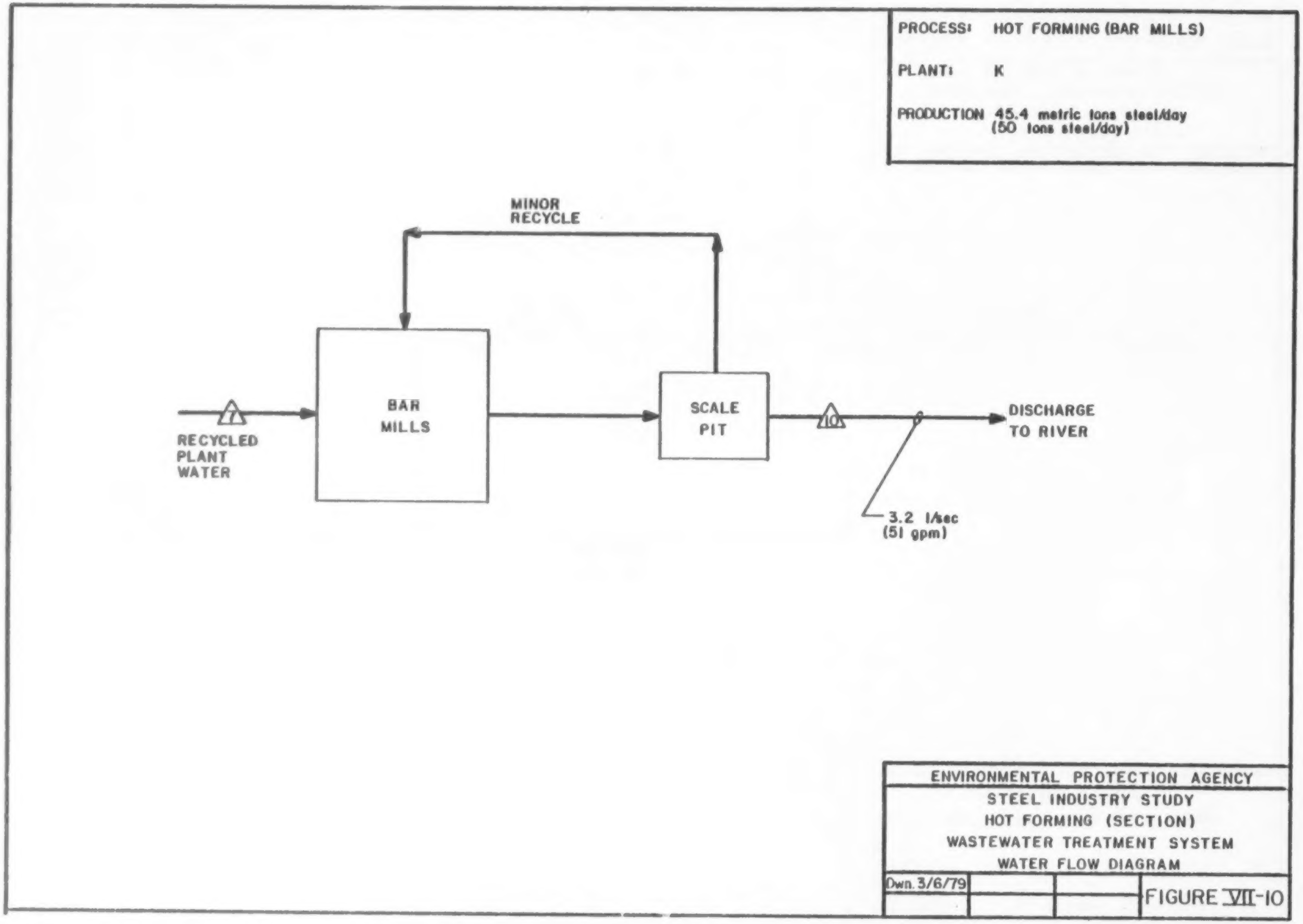

6.3 l/sec
(100 gpm)
7
RECYCLED
PLANT
WATER
BLOOMING
MILL
37.9 l/sec
(600 gpm)
11
44.2 l/sec
(700 gpm)
SCALE
PIT
12
6.3 l/sec
(100 gpm)
DISCHARGE
TO RIVER
SURFACE
OIL

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING (PRIMARY)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

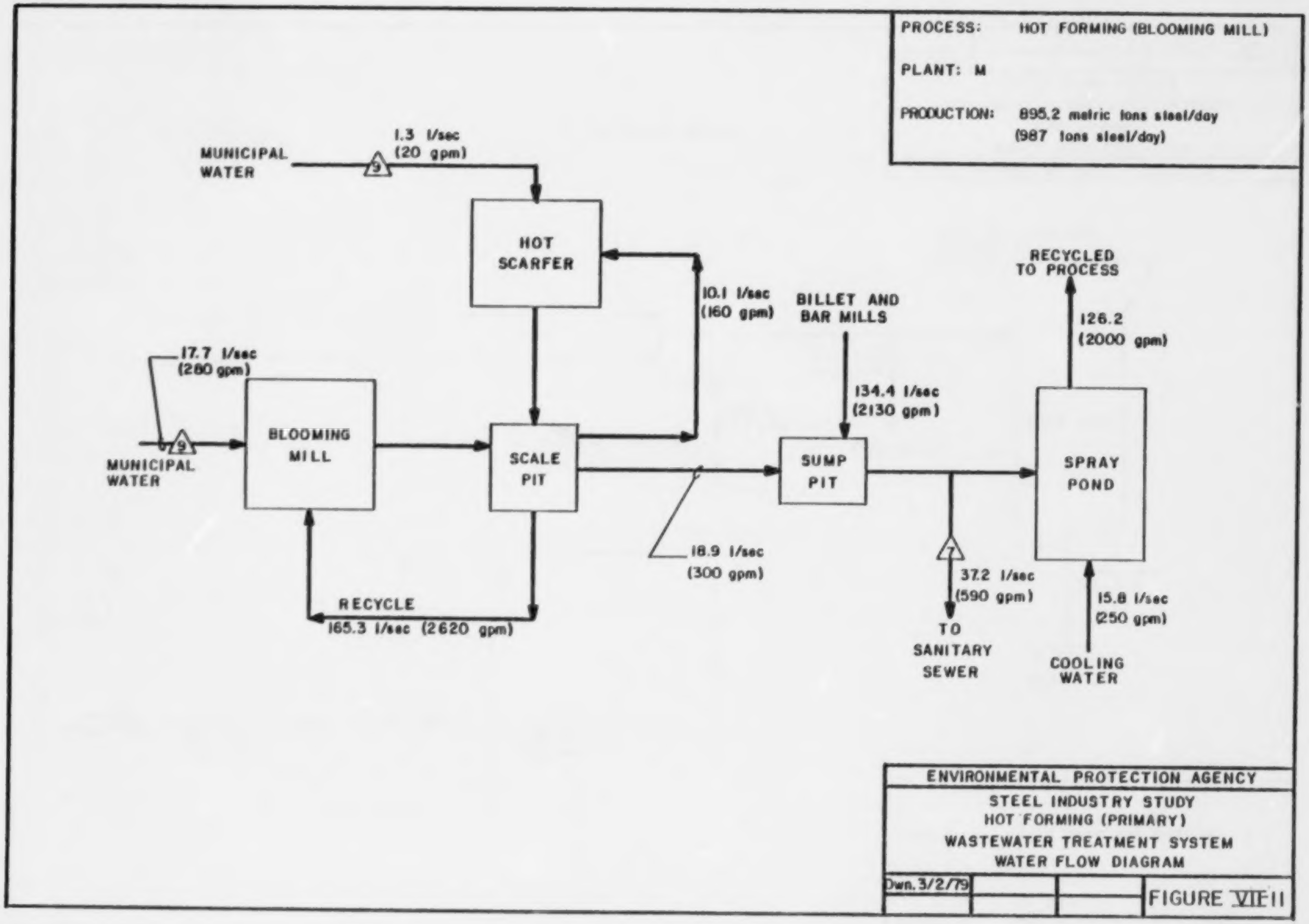
Dwn. 3/2/79

FIGURE VII-9


PROCESS: HOT FORMING (BAR MILLS)
PLANT: K
PRODUCTION 45.4 metric tons steel/day
(50 tons steel/day)
MINOR RECYCLE
7
RECYCLED PLANT WATER
BAR MILLS
SCALE PIT
10
DISCHARGE TO RIVER
3.2 l/sec
(51 gpm)
Dwn. 3/6/79

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (SECTION)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-10


MUNICIPAL WATER
1.3 l/sec
(20 gpm)
9
HOT SCARFER
10.1 l/sec
(160 gpm)
17.7 l/sec
(280 gpm)
MUNICIPAL WATER
9
BLOOMING MILL
SCALE PIT
RECYCLE
165.3 l/sec (2620 gpm)
18.9 l/sec
(300 gpm)
BILLET AND BAR MILLS
134.4 l/sec
(2130 gpm)
SUMP PIT
7
37.2 l/sec
(590 gpm)
TO SANITARY SEWER
RECYCLED TO PROCESS
126.2
(2000 gpm)
SPRAY POND
15.8 l/sec
(250 gpm)
COOLING WATER

PROCESS: HOT FORMING (BLOOMING MILL)

PLANT: M

PRODUCTION: 895.2 metric tons steel/day
(987 tons steel/day)

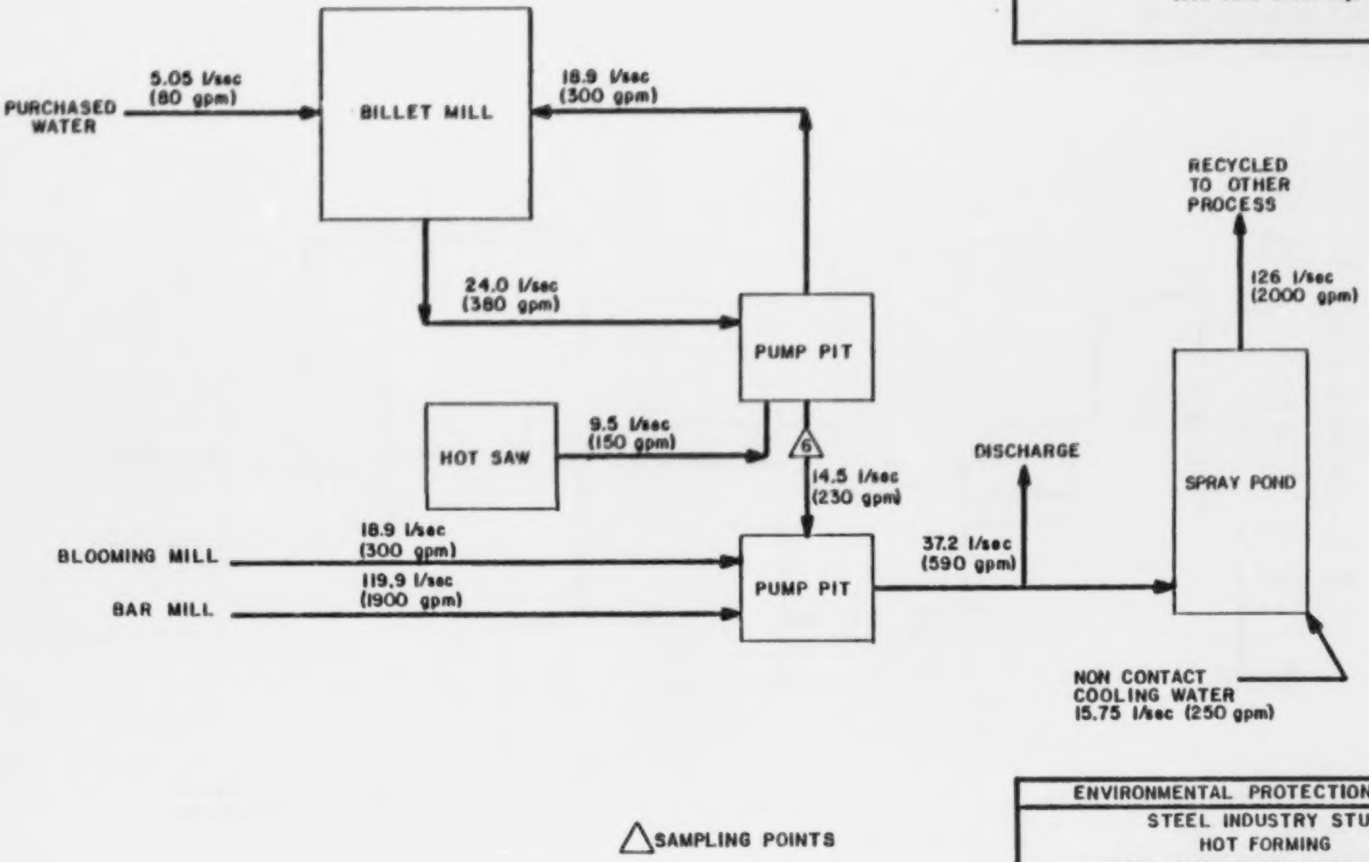
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (PRIMARY)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
Dwn. 3/2/79

FIGURE VII-11

PROCESS: HOT FORMING (BILLET MILL)

PLANT: M

PRODUCTION: 740.1 metric tons steel/day
(816 tons steel/day)


PURCHASED WATER
5.05 l/sec
(80 gpm)
BILLET MILL
18.9 l/sec
(300 gpm)
24.0 l/sec
(380 gpm)
PUMP PIT
HOT SAW
9.5 l/sec
(150 gpm)
6
14.5 l/sec
(230 gpm)
BLOOMING MILL
18.9 l/sec
(300 gpm)
BAR MILL
119.9 l/sec
(1900 gpm)
PUMP PIT
37.2 l/sec
(590 gpm)
DISCHARGE
SPRAY POND
126 l/sec
(2000 gpm)
RECYCLED TO OTHER PROCESS
NON CONTACT COOLING WATER
15.75 l/sec (250 gpm)
SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

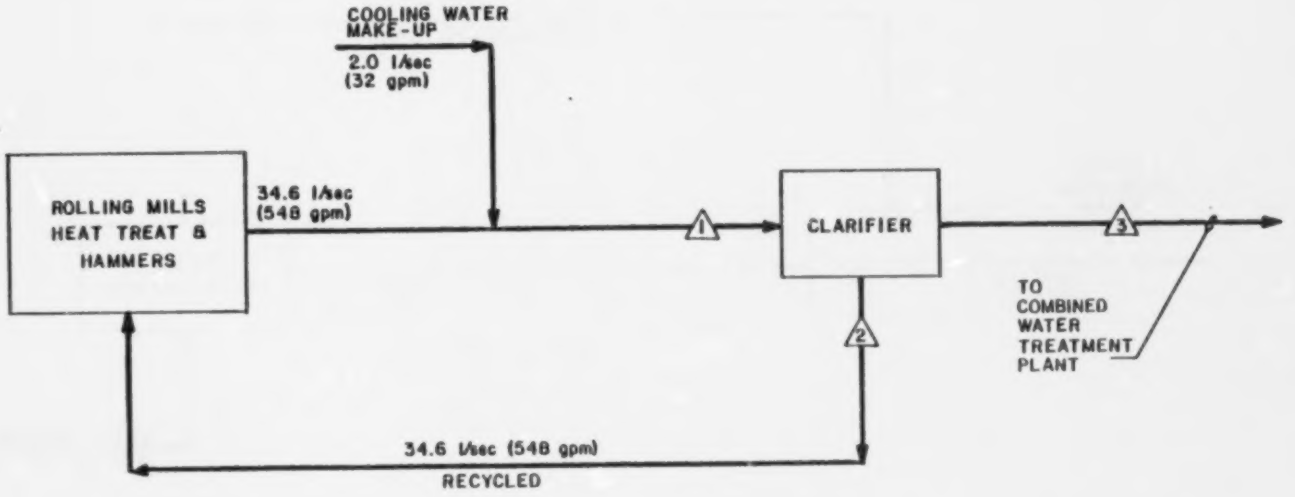
Dwn. 3/6/79

FIGURE VII-12

PROCESS: HOT FORMING - SECTION

PLANT: O

PRODUCTION: 152.6 metric tons steel/day
(168 tons steel/day)

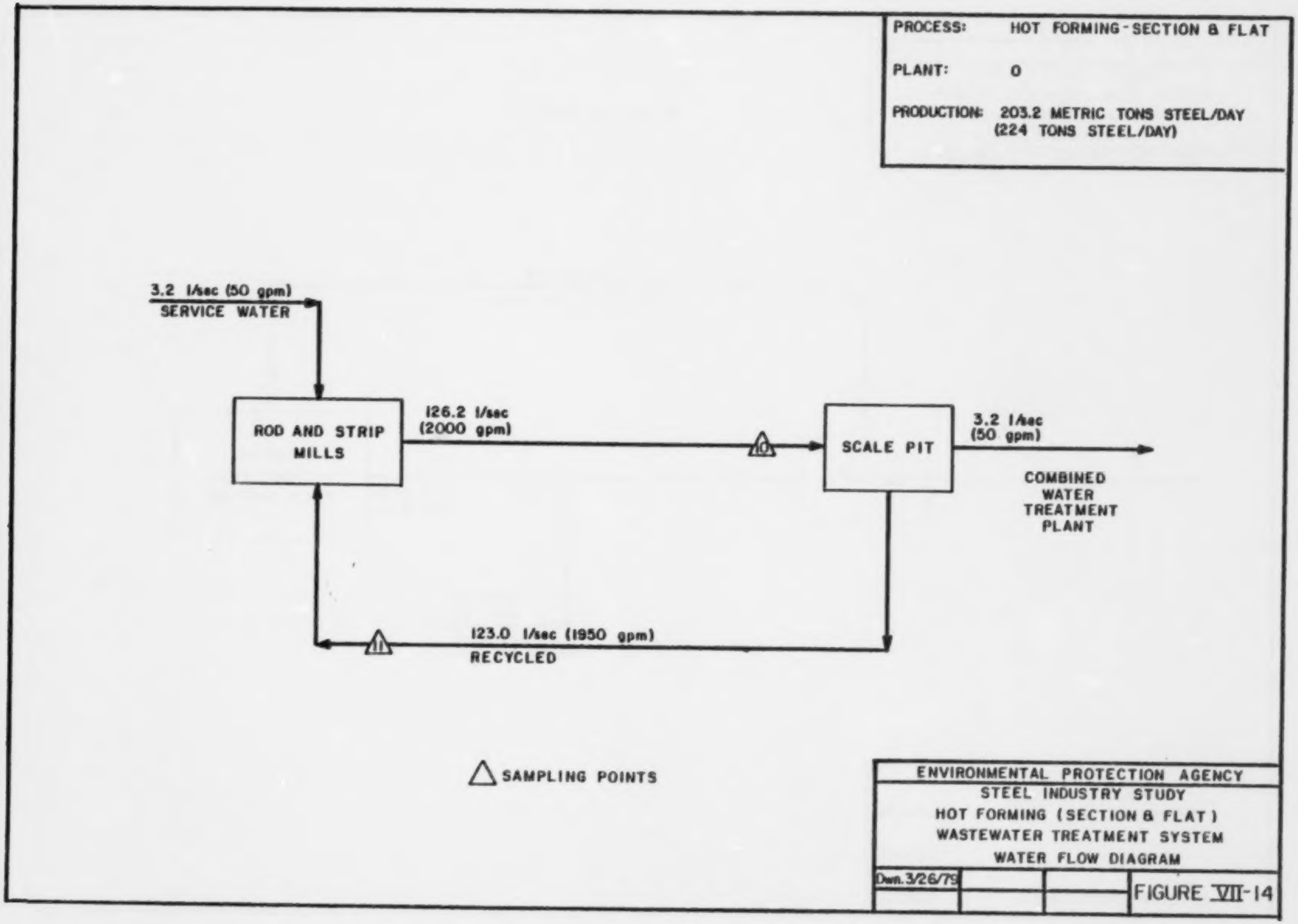

COOLING WATER MAKE-UP
2.0 l/sec
(32 gpm)
ROLLING MILLS HEAT TREAT & HAMMERS
34.6 l/sec
(548 gpm)
1
CLARIFIER
3
2
TO COMBINED WATER TREATMENT PLANT
34.6 l/sec (548 gpm)
RECYCLED

△ SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (SECTION)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/7/79

FIGURE VII-13


3.2 l/sec (50 gpm)
SERVICE WATER
ROD AND STRIP MILLS
126.2 l/sec (2000 gpm)
10
SCALE PIT
3.2 l/sec (50 gpm)
COMBINED WATER TREATMENT PLANT
11
123.0 l/sec (1950 gpm)
RECYCLED
△ SAMPLING POINTS

PROCESS: HOT FORMING - SECTION & FLAT

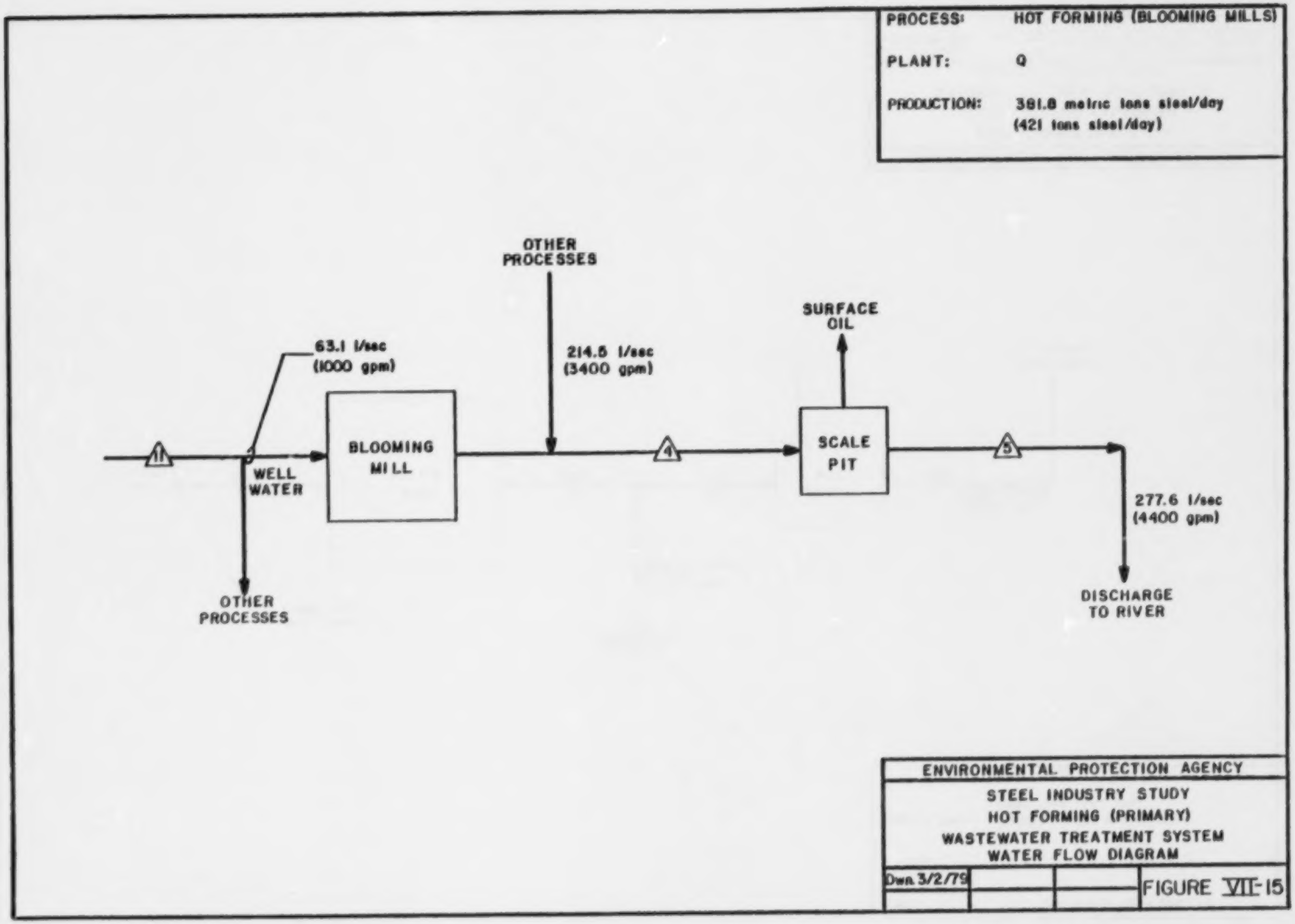
PLANT: O

PRODUCTION: 203.2 METRIC TONS STEEL/DAY (224 TONS STEEL/DAY)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (SECTION & FLAT)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/26/79

FIGURE VII-14



PROCESS: HOT FORMING (BLOOMING MILLS)

PLANT: Q

PRODUCTION: 381.8 metric tons steel/day
(421 tons steel/day)

1
WELL WATER
63.1 l/sec
(1000 gpm)
OTHER PROCESSES
BLOOMING MILL
OTHER PROCESSES
214.5 l/sec
(3400 gpm)
4
SURFACE OIL
SCALE PIT
5
277.6 l/sec
(4400 gpm)
DISCHARGE TO RIVER

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING (PRIMARY)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

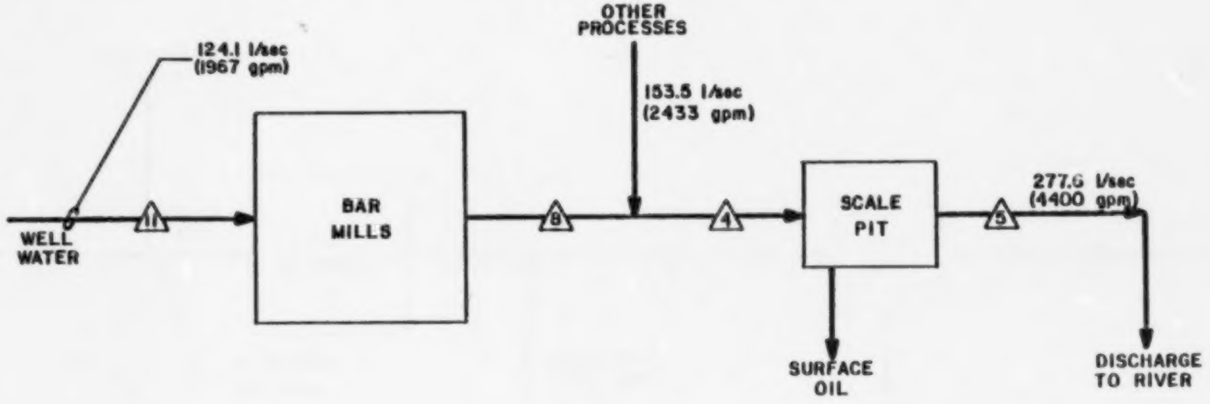
Dwn. 3/2/79

FIGURE VII-15

PROCESS: HOT FORMING (BAR MILLS)

PLANT: Q

PRODUCTION 1443.0 metric tons steel/day
(1591 tons steel/day)

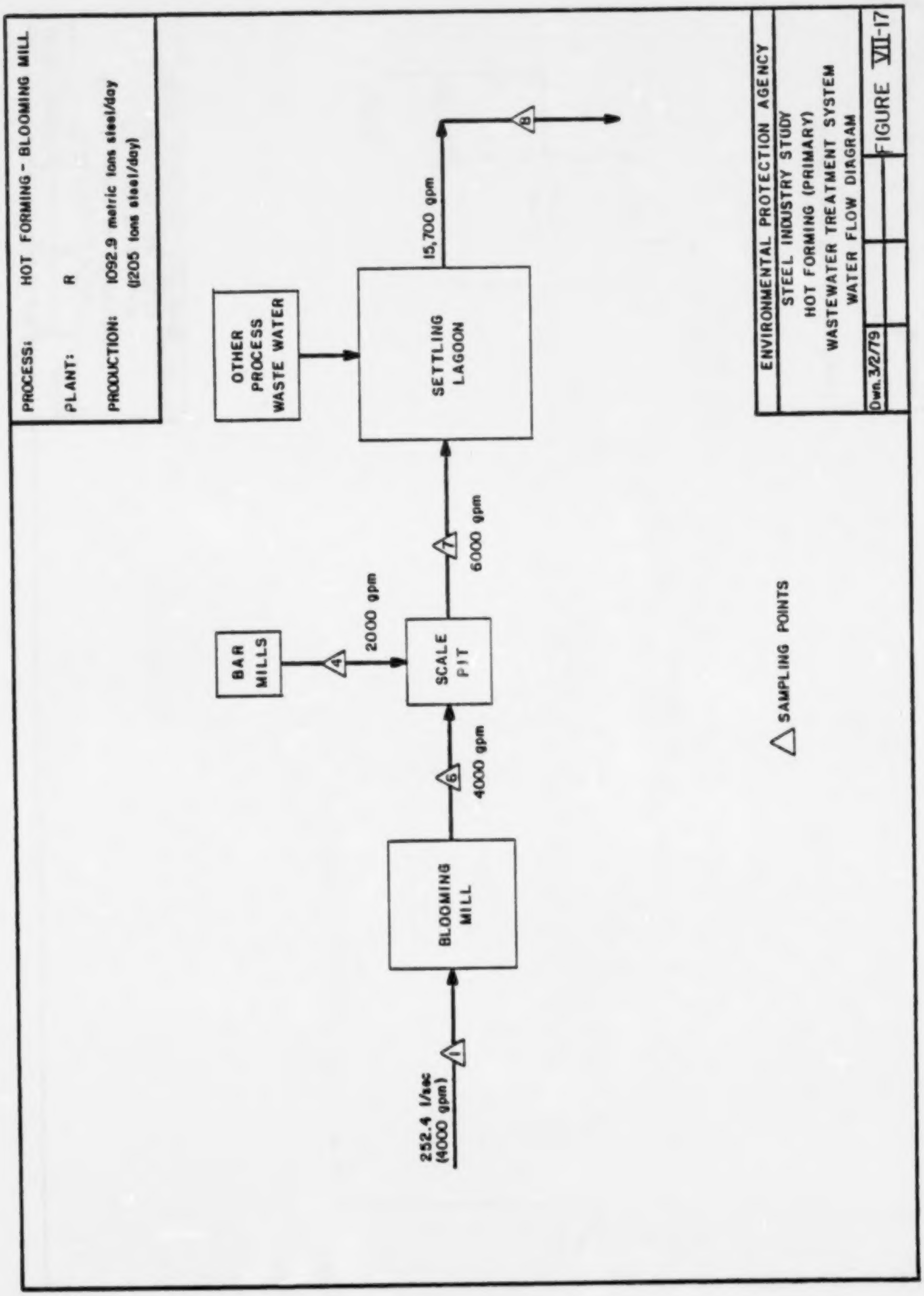

124.1 l/sec
(1967 gpm)
WELL WATER
11
BAR MILLS
8
OTHER PROCESSES
153.5 l/sec
(2433 gpm)
4
SCALE PIT
SURFACE OIL
5
277.6 l/sec
(4400 gpm)
DISCHARGE TO RIVER

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING (SECTION)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/7/79

FIGURE VII-16


PROCESS: HOT FORMING - BLOOMING MILL
PLANT: R
PRODUCTION: 1092.9 metric tons steel/day (1205 tons steel/day)
252.4 l/sec (4000 gpm)
1
BLOOMING MILL
6
4000 gpm
BAR MILLS
4
2000 gpm
SCALE PIT
7
6000 gpm
OTHER PROCESS WASTE WATER
SETTLING LAGOON
15,700 gpm
8
SAMPLING POINTS
Dwn. 3/2/79

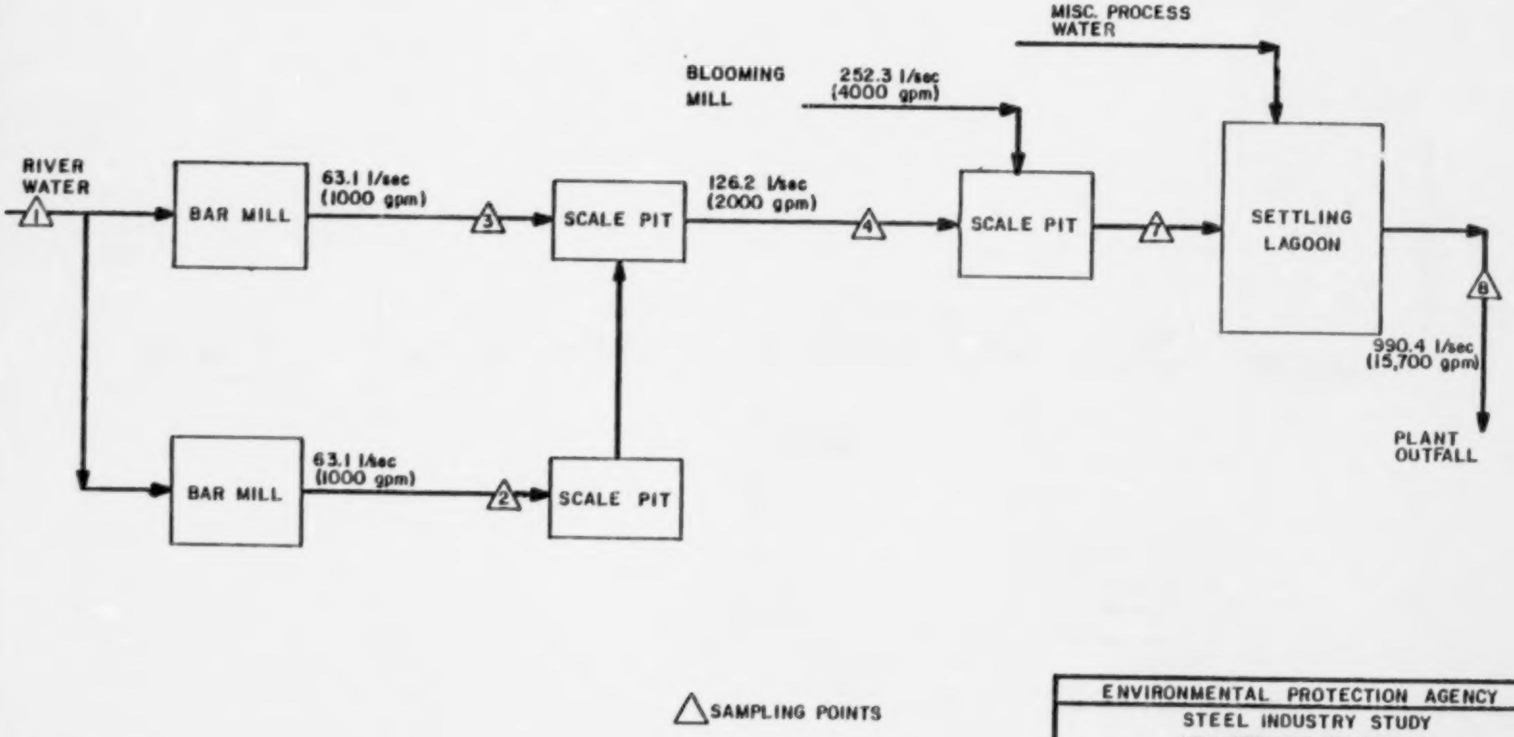
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (PRIMARY)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-17

PROCESS: HOT FORMING-BAR MILLS

PLANT: R

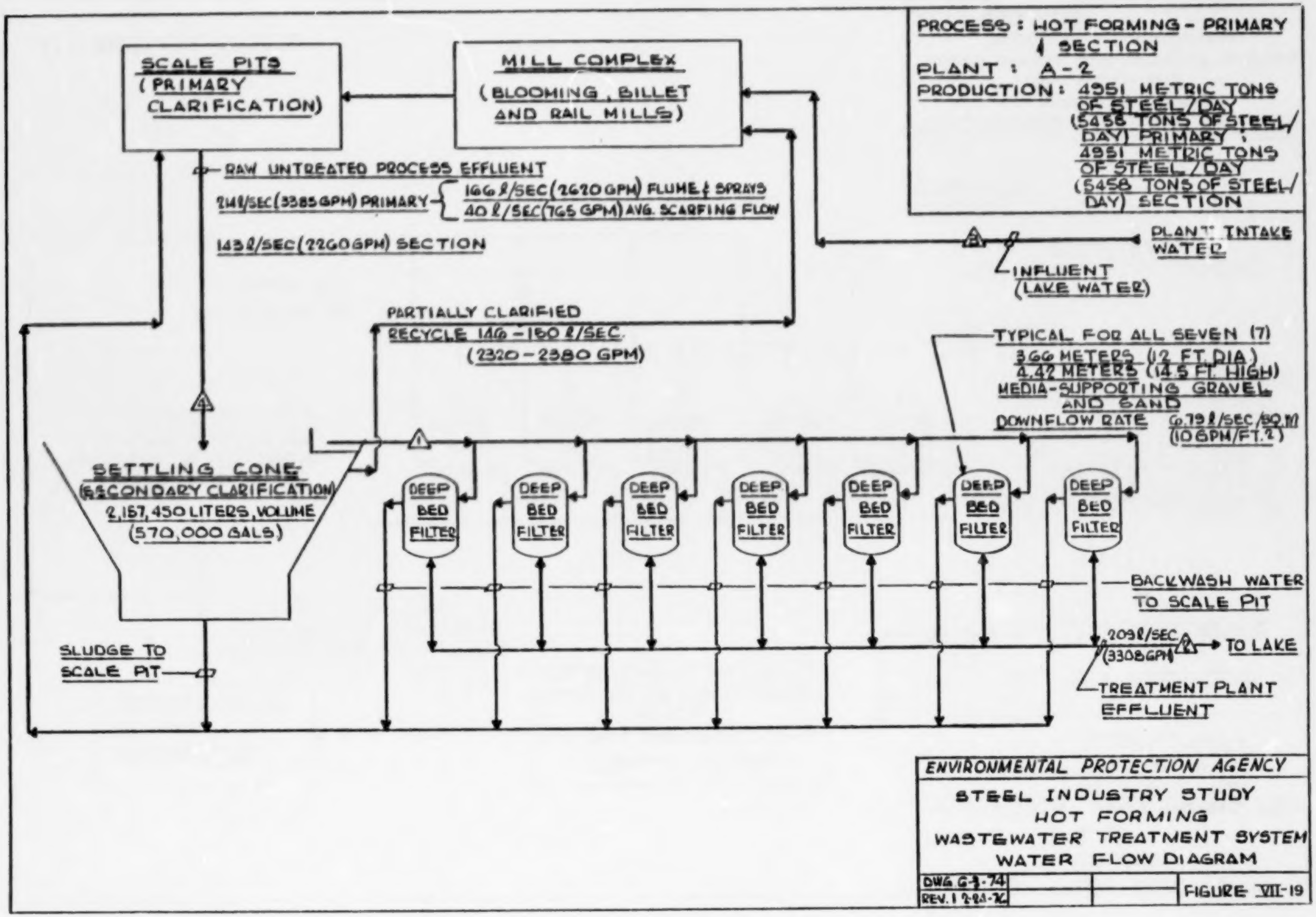
PRODUCTION: 328 metric tons steel/day
(362 tons steel/day)


RIVER WATER
1
BAR MILL
63.1 l/sec (1000 gpm)
3
SCALE PIT
BAR MILL
63.1 l/sec (1000 gpm)
2
SCALE PIT
126.2 l/sec (2000 gpm)
4
BLOOMING MILL
252.3 l/sec (4000 gpm)
SCALE PIT
7
MISC. PROCESS WATER
SETTLING LAGOON
8
990.4 l/sec (15,700 gpm)
PLANT OUTFALL
SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING (SECTION)
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/8/79

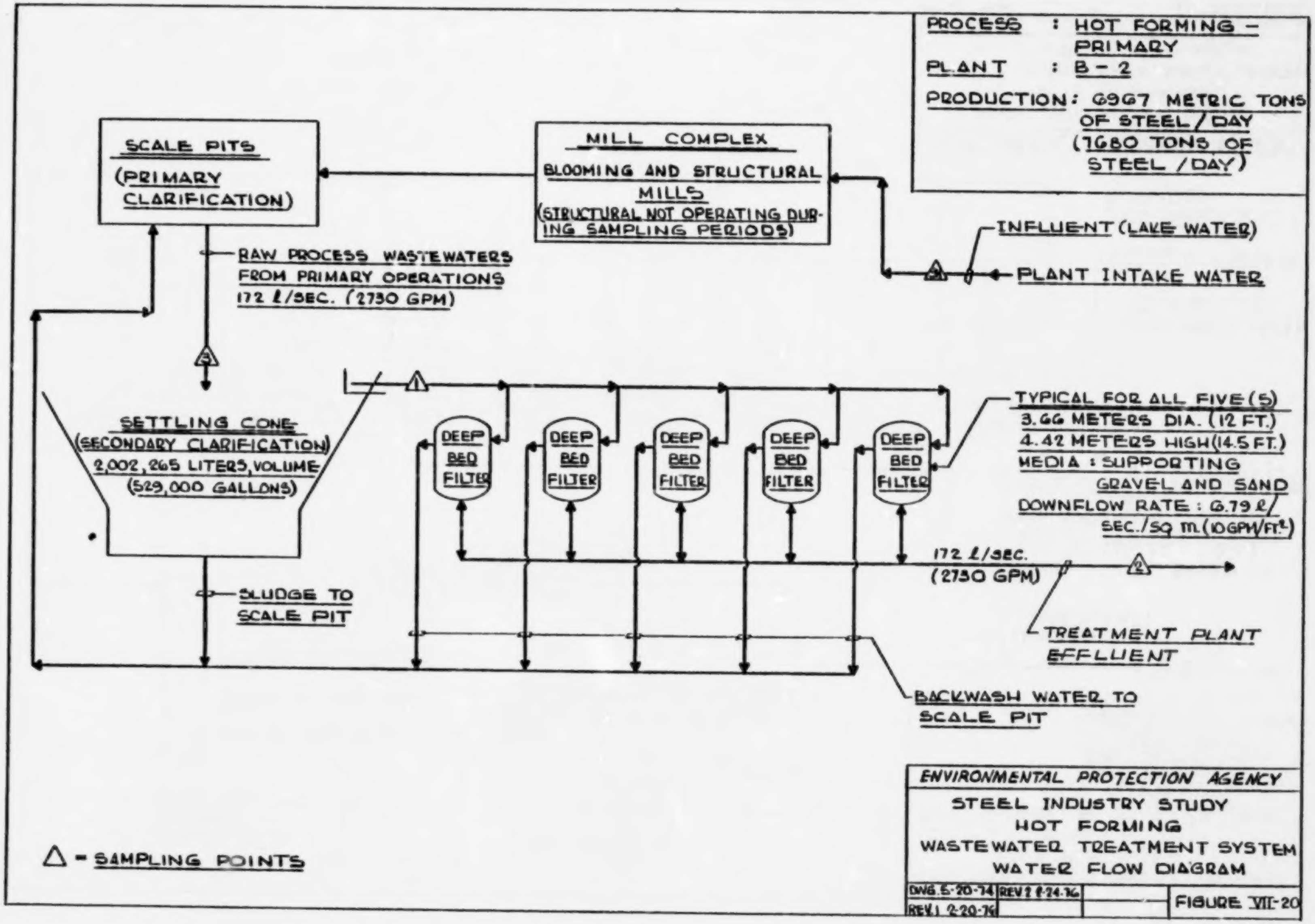
FIGURE VII-18


PROCESS : HOT FORMING - PRIMARY
& SECTION
PLANT : A-2
PRODUCTION : 4951 METRIC TONS OF STEEL/DAY (5456 TONS OF STEEL/DAY) PRIMARY ; 4951 METRIC TONS OF STEEL/DAY (5458 TONS OF STEEL/DAY) SECTION
SCALE PITS
(PRIMARY CLARIFICATION)
MILL COMPLEX
(BLOOMING, BILLET AND RAIL MILLS)
RAW UNTREATED PROCESS EFFLUENT
214 l/SEC (3385 GPM) PRIMARY
166 l/SEC (2620 GPM) FLUME & SPRAYS
40 l/SEC (765 GPM) AVG. SCARFING FLOW
143 l/SEC (2260 GPM) SECTION
PLANT INTAKE WATER
INFLUENT
(LAKE WATER)
PARTIALLY CLARIFIED
RECYCLE 146 - 150 l/SEC.
(2320 - 2380 GPM)
TYPICAL FOR ALL SEVEN (7)
3.66 METERS (12 FT. DIA.)
4.42 METERS (14.5 FT. HIGH)
MEDIA - SUPPORTING GRAVEL AND SAND
DOWNFLOW RATE 6.79 l/SEC/SQ.M
(10 GPM/FT.2)
SETTLING CONE
(SECONDARY CLARIFICATION)
2,157,450 LITERS, VOLUME
(570,000 GALS)
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
BACKWASH WATER
TO SCALE PIT
SLUDGE TO SCALE PIT
209 l/SEC
(3308 GPM)
TO LAKE
TREATMENT PLANT EFFLUENT
DWG G-3-74
REV. 1 2-24-76

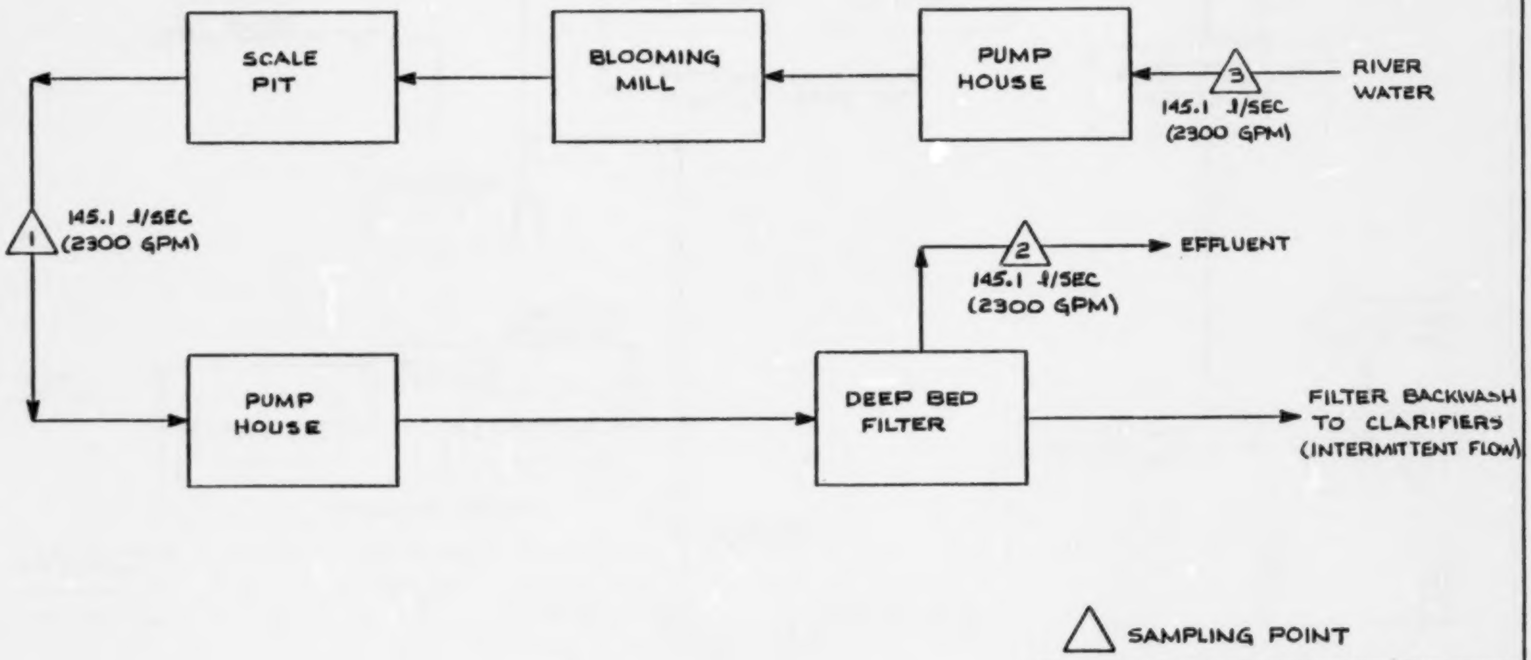
ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-19


ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
FIGURE VII-20
PROCESS : HOT FORMING - PRIMARY
PLANT : B - 2
PRODUCTION: 6967 METRIC TONS OF STEEL / DAY (7680 TONS OF STEEL / DAY)
SCALE PITS
(PRIMARY CLARIFICATION)
MILL COMPLEX
BLOOMING AND STRUCTURAL MILLS
(STRUCTURAL NOT OPERATING DURING SAMPLING PERIODS)
INFLUENT (LAKE WATER)
PLANT INTAKE WATER
RAW PROCESS WASTEWATERS FROM PRIMARY OPERATIONS
172 ℓ/SEC. (2730 GPM)
3
1
SETTLING CONE
(SECONDARY CLARIFICATION)
2,002,265 LITERS, VOLUME
(529,000 GALLONS)
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
DEEP BED FILTER
TYPICAL FOR ALL FIVE (5)
3.66 METERS DIA. (12 FT.)
4.42 METERS HIGH (14.5 FT.)
MEDIA : SUPPORTING GRAVEL AND SAND
DOWNFLOW RATE : 6.79 ℓ/SEC./SQ M. (10 GPM/FT.²)
172 ℓ/SEC.
(2730 GPM)
2
TREATMENT PLANT EFFLUENT
SLUDGE TO SCALE PIT
BACKWASH WATER TO SCALE PIT
△ - SAMPLING POINTS
DWG. 5-20-74
REV 2 8-24-76
REV 1 2-20-76

PROCESS : HOT FORMING - PRIMARY
PLANT : C-2
PRODUCTION : 3856 METRIC TONS OF STEEL/DAY
(4250 TONS OF STEEL/DAY)

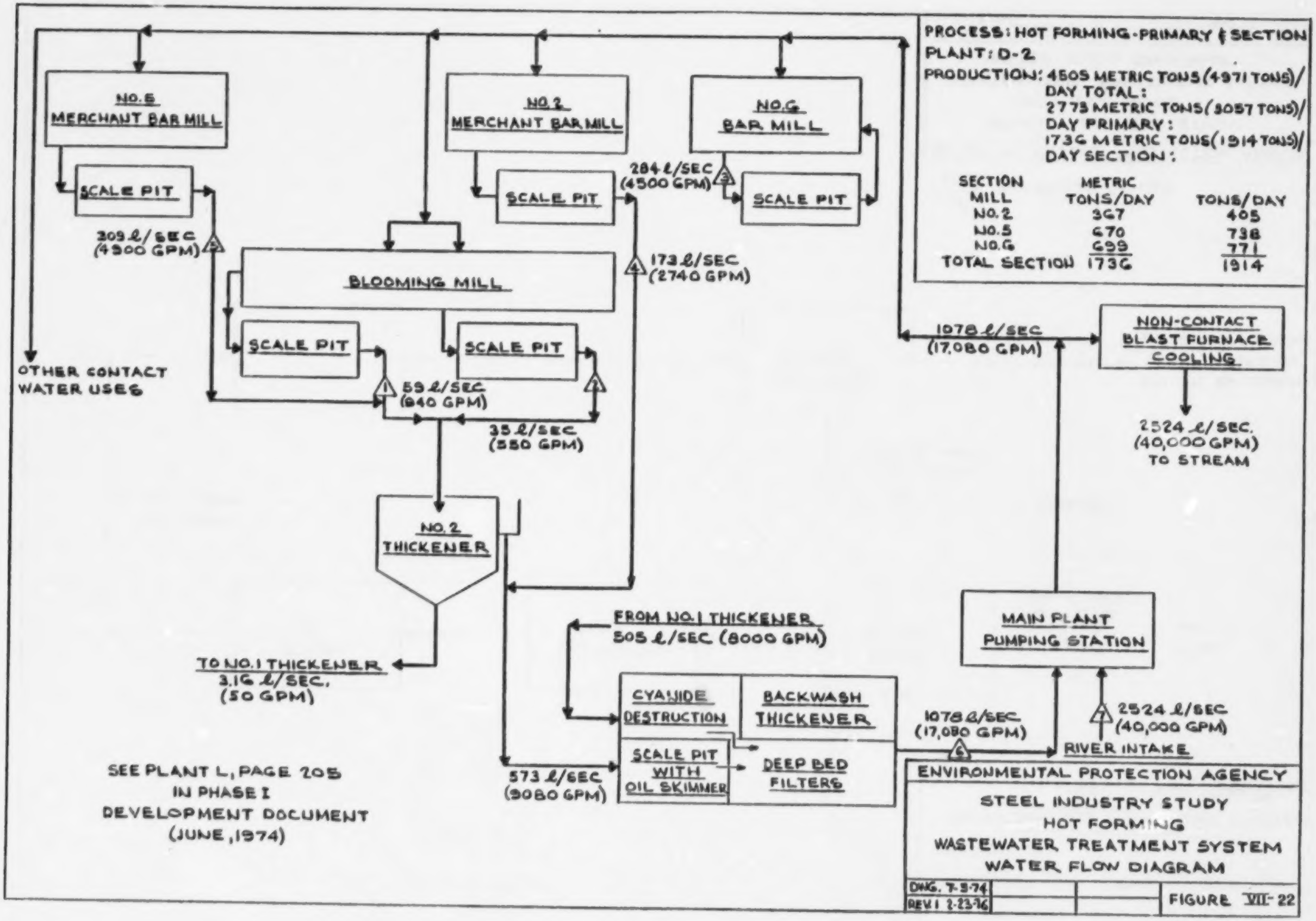

SCALE PIT
BLOOMING MILL
PUMP HOUSE
RIVER WATER
3
145.1 l/SEC (2300 GPM)
1
145.1 l/SEC (2300 GPM)
2
145.1 l/SEC (2300 GPM)
EFFLUENT
PUMP HOUSE
DEEP BED FILTER
FILTER BACKWASH TO CLARIFIERS (INTERMITTENT FLOW)
SAMPLING POINT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

4-2-74
REV 2-19-76

FIGURE VII-21


NO. 5 MERCHANT BAR MILL
NO. 2 MERCHANT BAR MILL
NO. 6 BAR MILL
SCALE PIT
SCALE PIT
SCALE PIT
284 ℓ/SEC (4500 GPM)
3
309 ℓ/SEC (4900 GPM)
5
BLOOMING MILL
4
173 ℓ/SEC (2740 GPM)
SCALE PIT
SCALE PIT
OTHER CONTACT WATER USES
1
59 ℓ/SEC (940 GPM)
2
35 ℓ/SEC (550 GPM)
NO. 2 THICKENER
TO NO. 1 THICKENER 3.16 ℓ/SEC. (50 GPM)
FROM NO. 1 THICKENER 505 ℓ/SEC (8000 GPM)
CYANIDE DESTRUCTION
BACKWASH THICKENER
SCALE PIT WITH OIL SKIMMER
DEEP BED FILTERS
573 ℓ/SEC (9080 GPM)
1078 ℓ/SEC (17,080 GPM)
6
1078 ℓ/SEC (17,080 GPM)
NON-CONTACT BLAST FURNACE COOLING
2524 ℓ/SEC. (40,000 GPM) TO STREAM
MAIN PLANT PUMPING STATION
7
2524 ℓ/SEC (40,000 GPM)
RIVER INTAKE
SEE PLANT L, PAGE 205 IN PHASE I DEVELOPMENT DOCUMENT (JUNE, 1974)
DWG. 7-3-74
REV 1 2-23-76

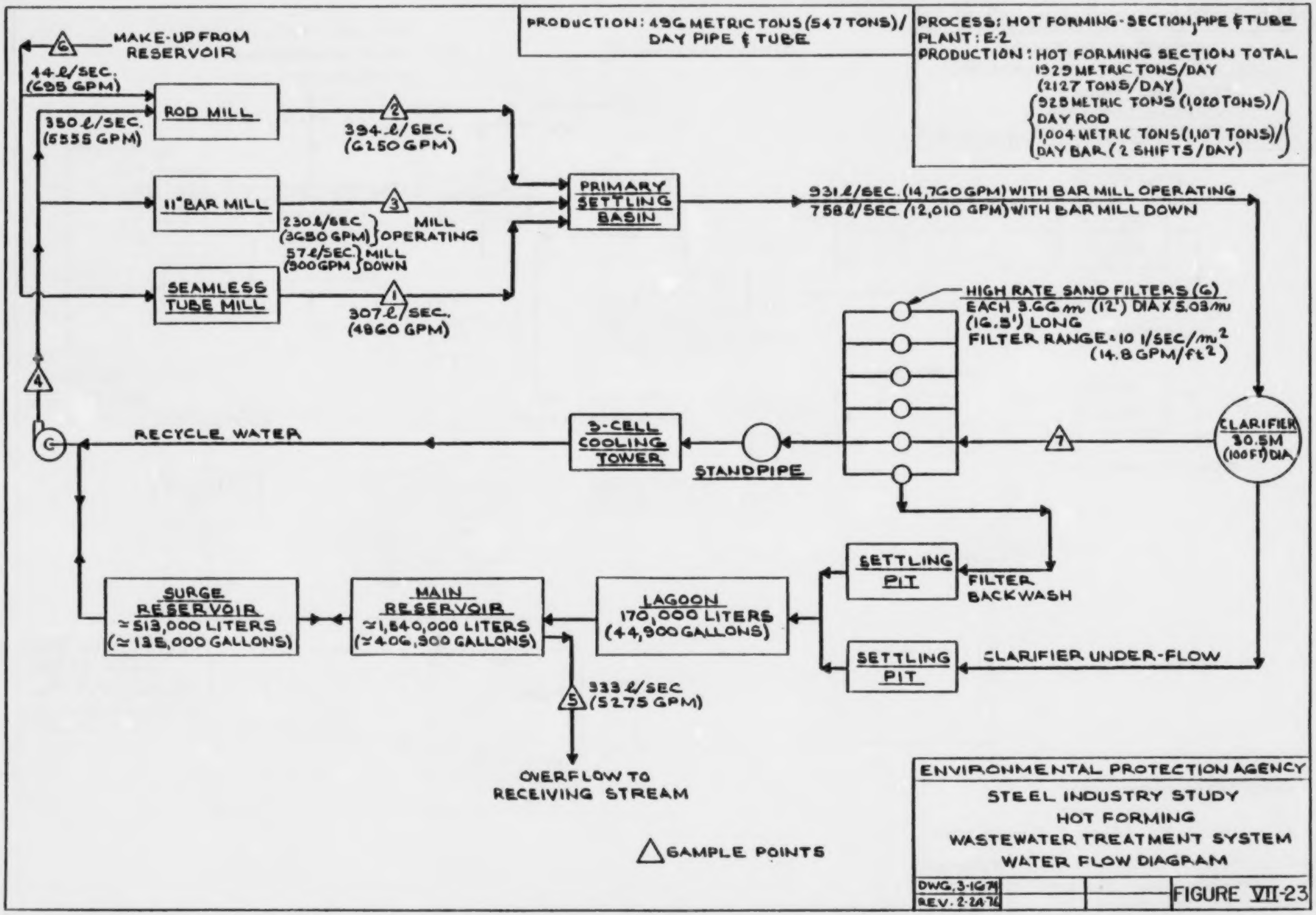
PROCESS: HOT FORMING - PRIMARY & SECTION
PLANT: D-2
PRODUCTION: 4505 METRIC TONS (4971 TONS)/DAY TOTAL:
2773 METRIC TONS (3057 TONS)/DAY PRIMARY:
1736 METRIC TONS (1914 TONS)/DAY SECTION:

SECTION MILL	METRIC TONS/DAY	TONS/DAY
NO. 2	367	405
NO. 5	670	738
NO. 6	699	771
TOTAL SECTION	1736	1914

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

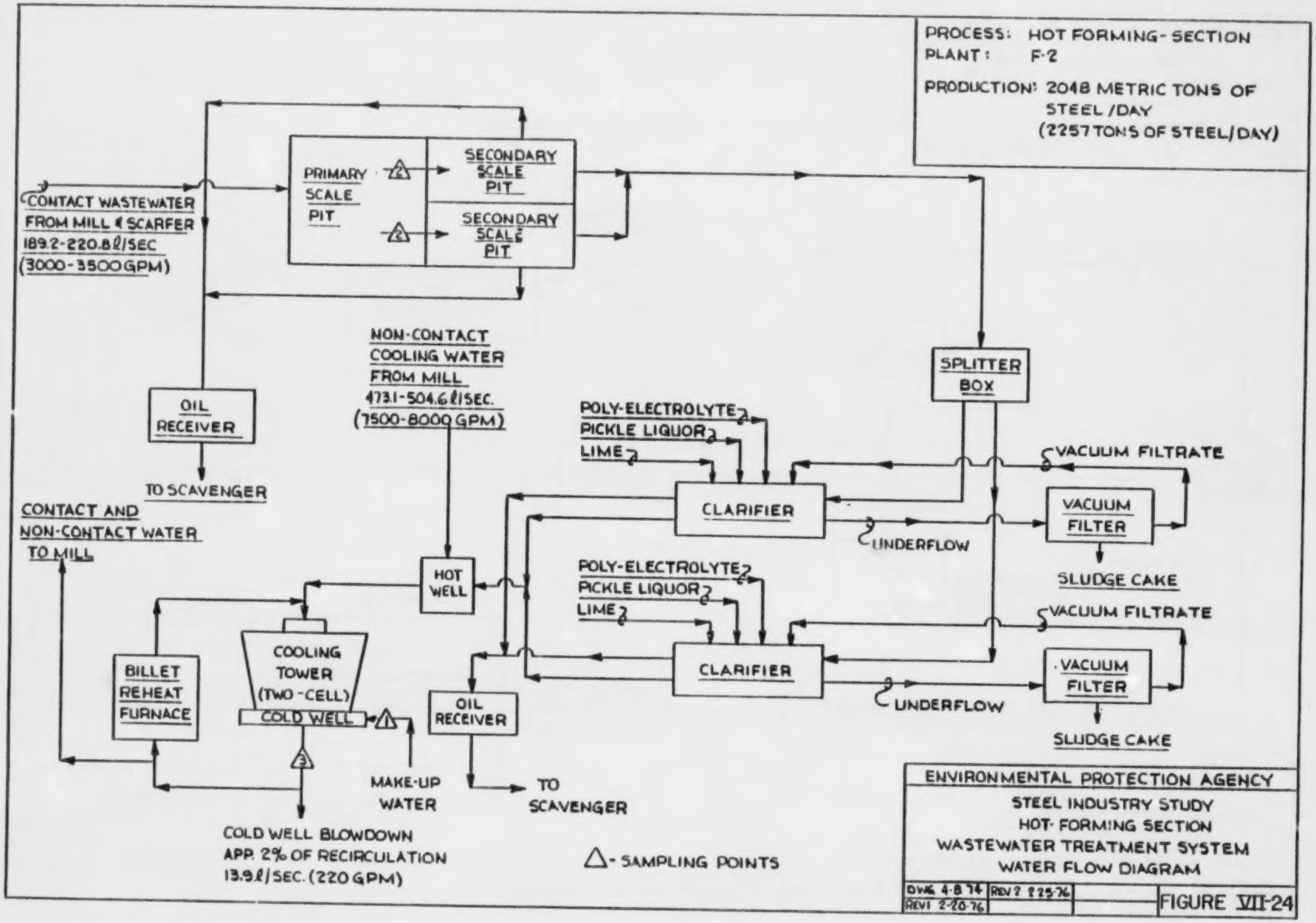
FIGURE VII-22


PRODUCTION: 496 METRIC TONS (547 TONS)/ DAY PIPE & TUBE
PROCESS: HOT FORMING-SECTION, PIPE & TUBE
PLANT: E-2
PRODUCTION: HOT FORMING SECTION TOTAL
1929 METRIC TONS/DAY
(2127 TONS/DAY)
925 METRIC TONS (1,020 TONS)/ DAY ROD
1,004 METRIC TONS (1,107 TONS)/ DAY BAR (2 SHIFTS/DAY)
6
MAKE-UP FROM RESERVOIR
44 ℓ/SEC. (695 GPM)
350 ℓ/SEC. (5555 GPM)
ROD MILL
2
394 ℓ/SEC. (6250 GPM)
11" BAR MILL
3
230 ℓ/SEC (3650 GPM) MILL OPERATING
57 ℓ/SEC. (900 GPM) MILL DOWN
SEAMLESS TUBE MILL
1
307 ℓ/SEC. (4860 GPM)
PRIMARY SETTLING BASIN
931 ℓ/SEC. (14,760 GPM) WITH BAR MILL OPERATING
758 ℓ/SEC. (12,010 GPM) WITH BAR MILL DOWN
HIGH RATE SAND FILTERS (6)
EACH 3.66 m (12') DIA X 5.03 m (16.5') LONG
FILTER RANGE = 10 l/SEC/m² (14.8 GPM/ft²)
CLARIFIER 30.5M (100 FT) DIA.
7
4
RECYCLE WATER
3-CELL COOLING TOWER
STANDPIPE
SETTLING PIT
FILTER BACKWASH
SETTLING PIT
CLARIFIER UNDER-FLOW
LAGOON 170,000 LITERS (44,900 GALLONS)
MAIN RESERVOIR ≃1,840,000 LITERS (≃406,900 GALLONS)
SURGE RESERVOIR ≃513,000 LITERS (≃135,000 GALLONS)
5
333 ℓ/SEC (5275 GPM)
OVERFLOW TO RECEIVING STREAM
△ SAMPLE POINTS
DWG. 3-1674
REV. 2-24-76

ENVIRONMENTAL PROTECTION AGENCY

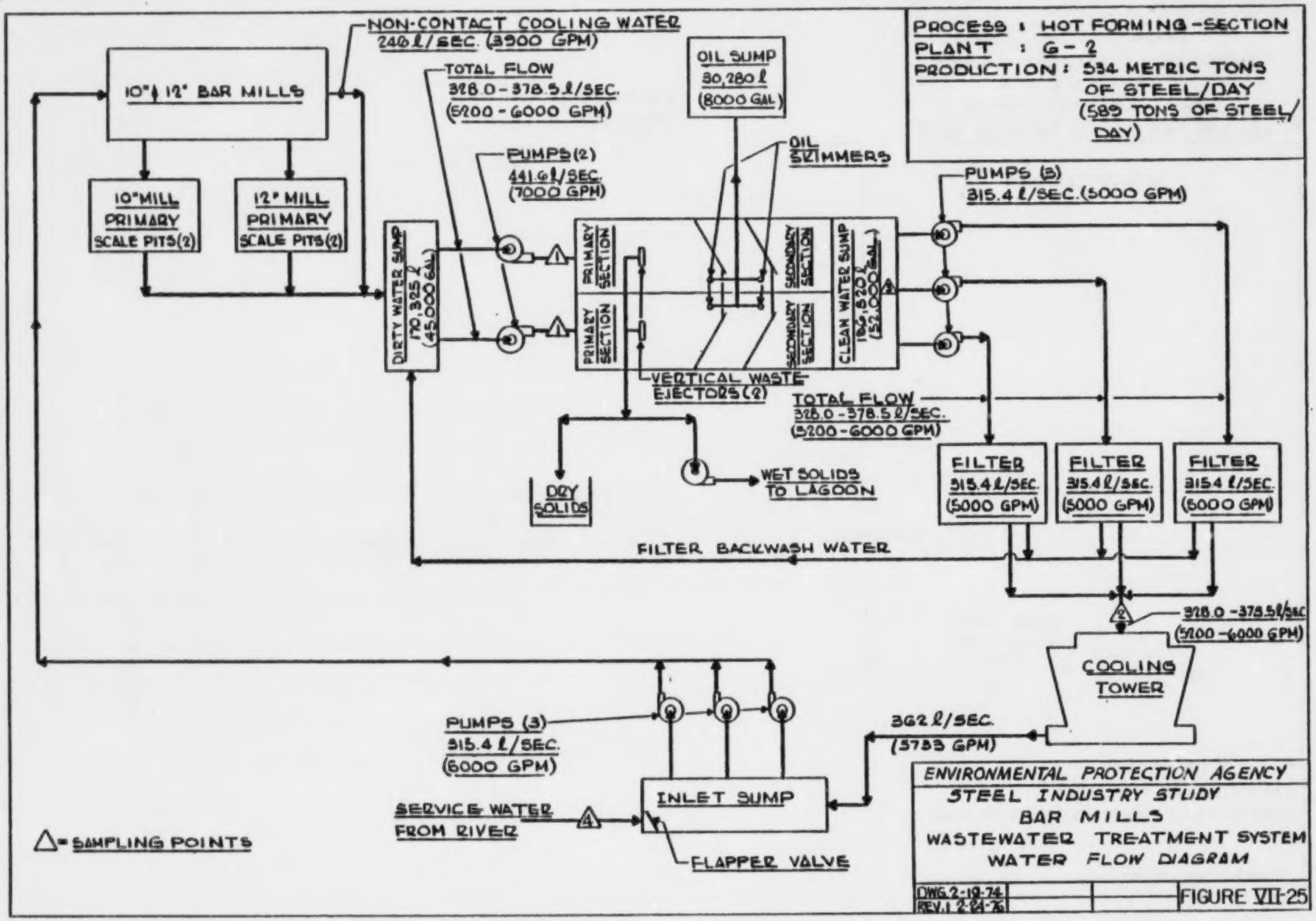
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-23


PROCESS: HOT FORMING-SECTION
PLANT: F-2
PRODUCTION: 2048 METRIC TONS OF STEEL/DAY (2257 TONS OF STEEL/DAY)
CONTACT WASTEWATER FROM MILL & SCARFER 189.2-220.8 l/SEC (3000-3500 GPM)
PRIMARY SCALE PIT
2
SECONDARY SCALE PIT
SECONDARY SCALE PIT
OIL RECEIVER
TO SCAVENGER
CONTACT AND NON-CONTACT WATER TO MILL
NON-CONTACT COOLING WATER FROM MILL 473.1-504.6 l/SEC. (7500-8000 GPM)
SPLITTER BOX
POLY-ELECTROLYTE
PICKLE LIQUOR
LIME
CLARIFIER
VACUUM FILTRATE
VACUUM FILTER
UNDERFLOW
SLUDGE CAKE
POLY-ELECTROLYTE
PICKLE LIQUOR
LIME
CLARIFIER
VACUUM FILTRATE
VACUUM FILTER
UNDERFLOW
SLUDGE CAKE
HOT WELL
BILLET REHEAT FURNACE
COOLING TOWER (TWO-CELL)
COLD WELL
1
3
MAKE-UP WATER
OIL RECEIVER
TO SCAVENGER
COLD WELL BLOWDOWN APP. 2% OF RECIRCULATION 13.9 l/SEC. (220 GPM)
△ - SAMPLING POINTS
DWG 4-8-74
REV 1 2-20-76
REV 2 2-25-76

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT-FORMING SECTION
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-24


PROCESS : HOT FORMING - SECTION
PLANT : G - 2
PRODUCTION : 534 METRIC TONS OF STEEL/DAY (589 TONS OF STEEL/DAY)
NON-CONTACT COOLING WATER 246 l/SEC. (3900 GPM)
10" & 12" BAR MILLS
10" MILL PRIMARY SCALE PITS (2)
12" MILL PRIMARY SCALE PITS (2)
TOTAL FLOW 328.0 - 378.5 l/SEC. (5200 - 6000 GPM)
PUMPS (2) 441.6 l/SEC. (7000 GPM)
DIRTY WATER SUMP 170,325 l (45,000 GAL)
OIL SUMP 30,280 l (8000 GAL)
OIL SKIMMERS
PRIMARY SECTION
PRIMARY SECTION
SECONDARY SECTION
SECONDARY SECTION
CLEAN WATER SUMP 196,820 l (52,000 GAL)
VERTICAL WASTE EJECTORS (2)
PUMPS (3) 315.4 l/SEC. (5000 GPM)
TOTAL FLOW 328.0 - 378.5 l/SEC. (5200 - 6000 GPM)
DRY SOLIDS
WET SOLIDS TO LAGOON
FILTER 315.4 l/SEC. (5000 GPM)
FILTER 315.4 l/SEC. (5000 GPM)
FILTER 315.4 l/SEC. (5000 GPM)
FILTER BACKWASH WATER
328.0 - 378.5 l/SEC (5200 - 6000 GPM)
COOLING TOWER
362 l/SEC. (5733 GPM)
PUMPS (3) 315.4 l/SEC. (6000 GPM)
INLET SUMP
SERVICE WATER FROM RIVER
FLAPPER VALVE
△ = SAMPLING POINTS
1
1
2
3
4
DWG. 2-19-74
REV. 1 2-24-76

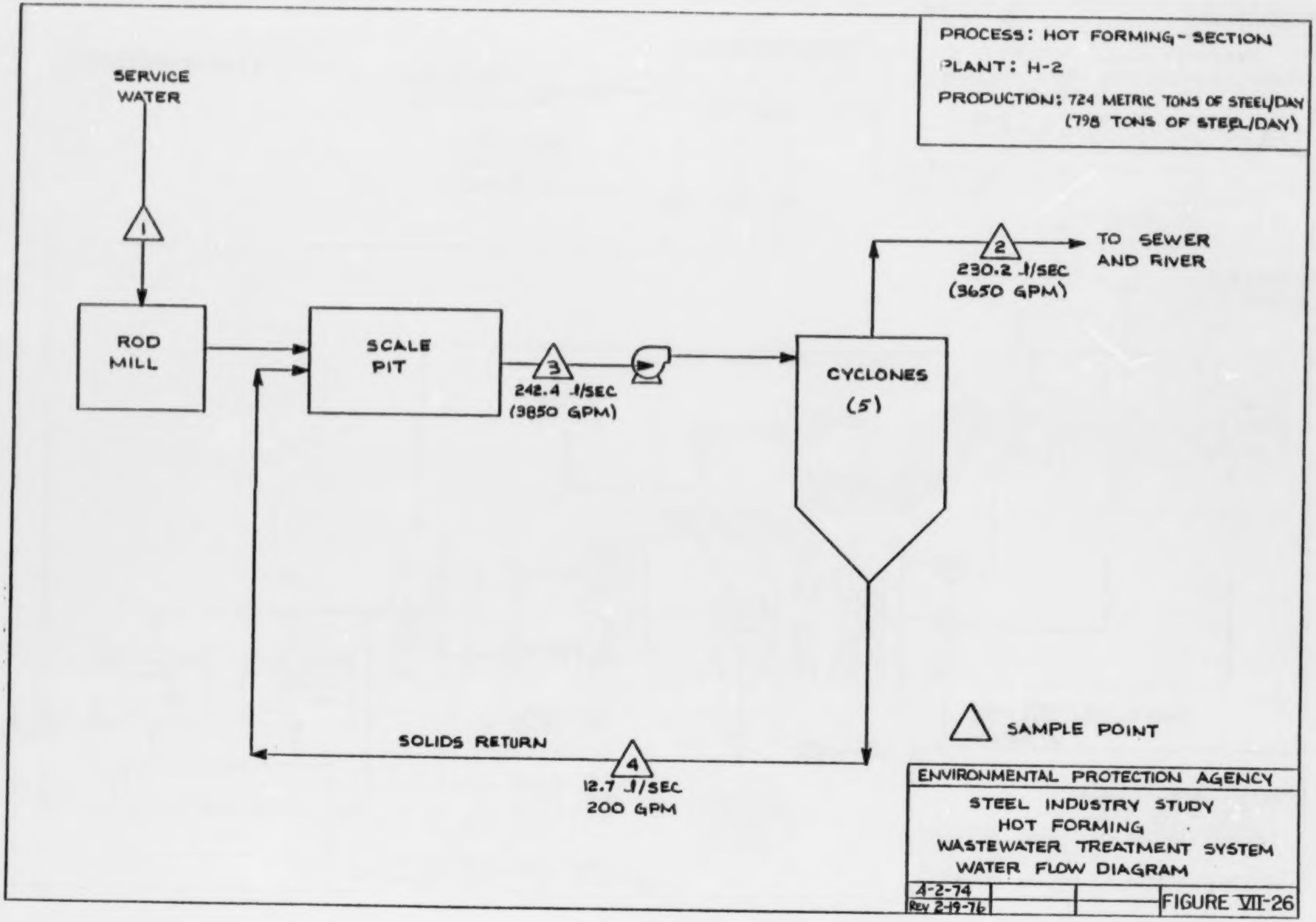
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
BAR MILLS
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-25

PROCESS: HOT FORMING - SECTION

PLANT: H-2

PRODUCTION: 724 METRIC TONS OF STEEL/DAY
(798 TONS OF STEEL/DAY)

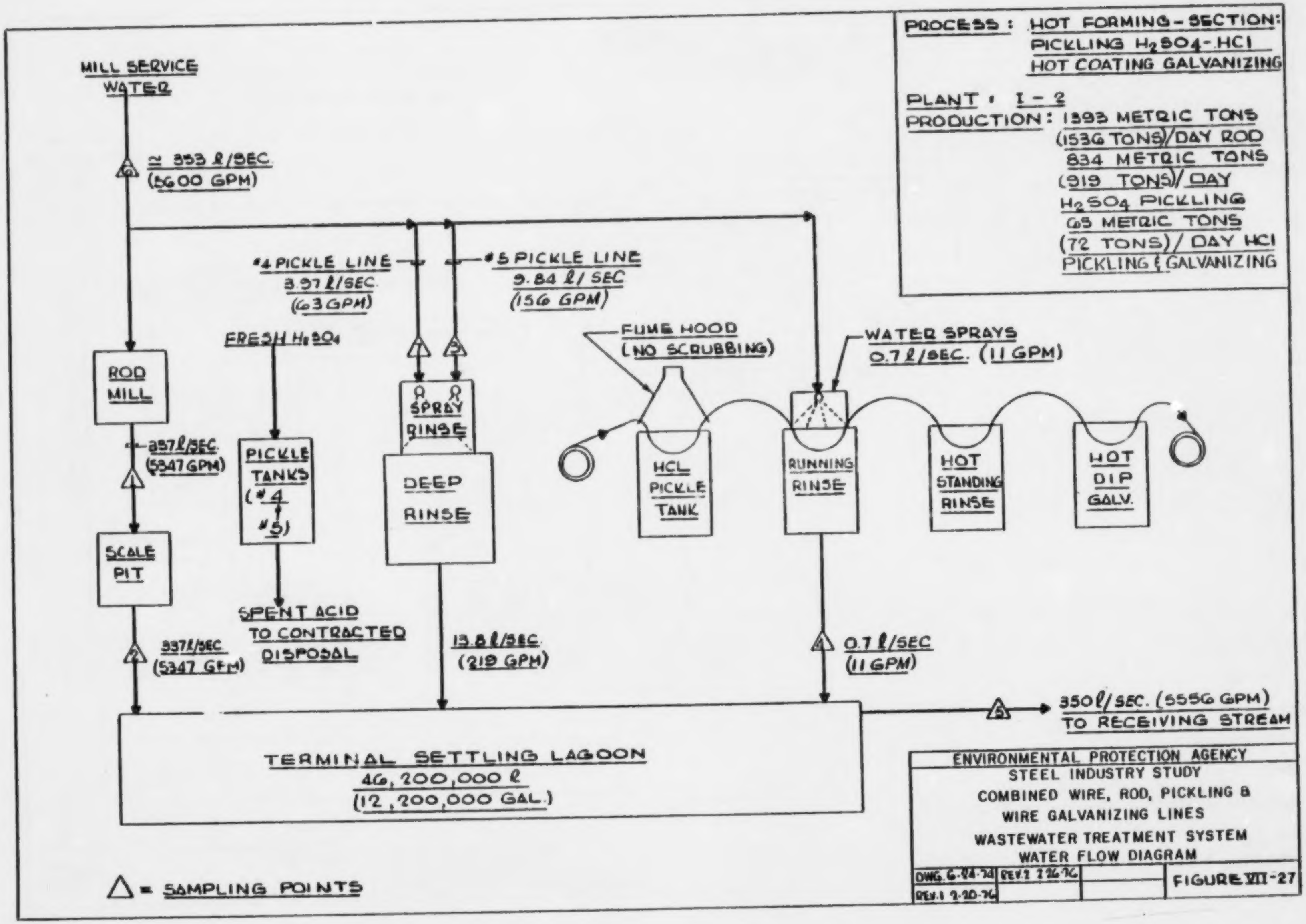

SERVICE WATER
1
ROD MILL
SCALE PIT
3
242.4 l/SEC
(3850 GPM)
CYCLONES (5)
2
230.2 l/SEC
(3650 GPM)
TO SEWER AND RIVER
SOLIDS RETURN
4
12.7 l/SEC
200 GPM
SAMPLE POINT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

4-2-74
Rev 2-19-76

FIGURE VII-26

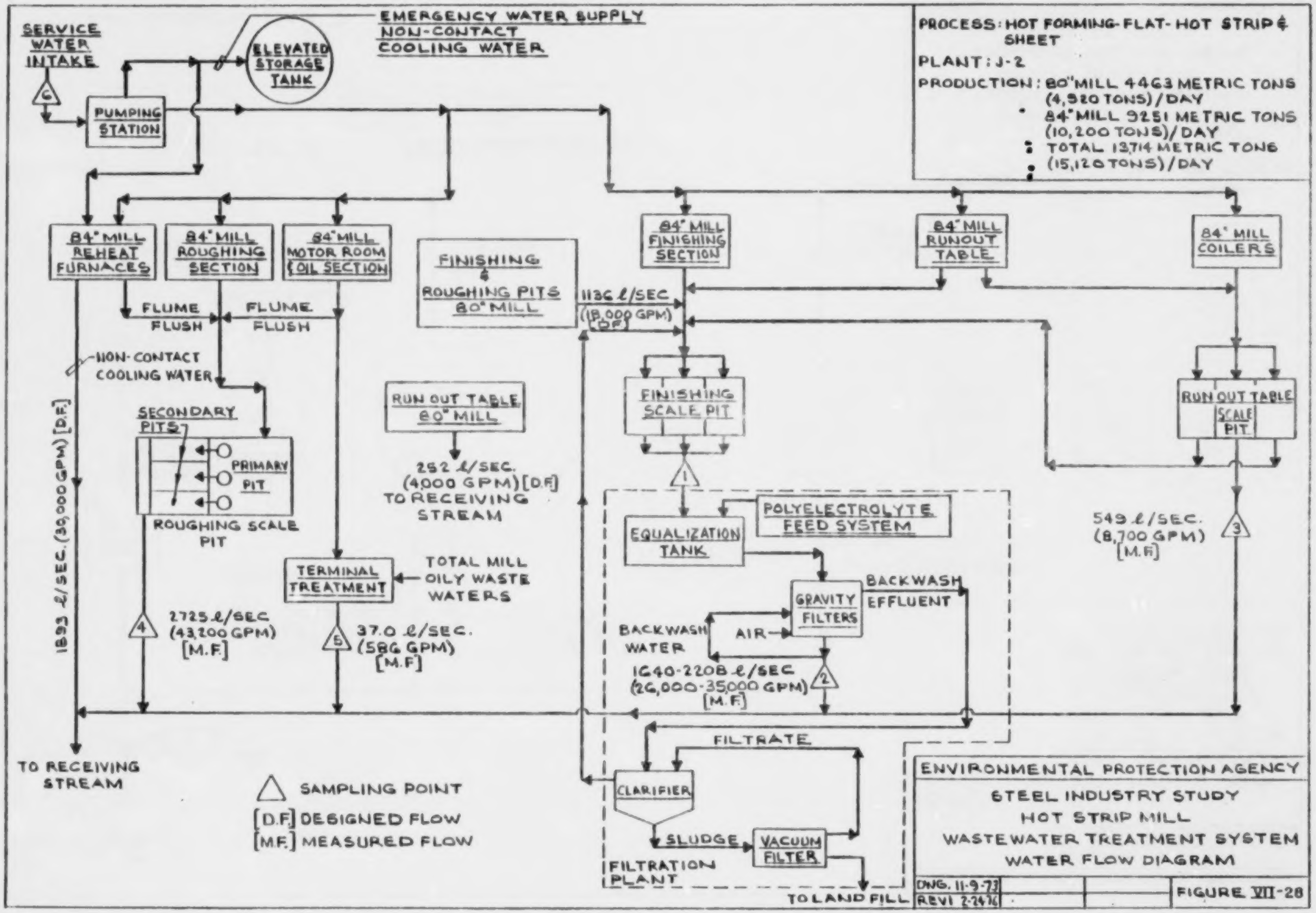


PROCESS : HOT FORMING - SECTION: PICKLING H_2SO_4-HCl HOT COATING GALVANIZING
PLANT : I - 2
PRODUCTION : 1393 METRIC TONS (1536 TONS)/DAY ROD 834 METRIC TONS (919 TONS)/DAY H_2SO_4 PICKLING 65 METRIC TONS (72 TONS)/ DAY HCl PICKLING & GALVANIZING
MILL SERVICE WATER
6
≃ 353 ℓ/SEC. (5600 GPM)
ROD MILL
337 ℓ/SEC. (5347 GPM)
1
SCALE PIT
2
337 ℓ/SEC (5347 GPM)
#4 PICKLE LINE 3.97 ℓ/SEC. (63 GPM)
#5 PICKLE LINE 9.84 ℓ/SEC (156 GPM)
FRESH H_2SO_4
PICKLE TANKS (#4 & #5)
SPENT ACID TO CONTRACTED DISPOSAL
7
3
SPRAY RINSE
DEEP RINSE
13.8 ℓ/SEC. (219 GPM)
FUME HOOD (NO SCRUBBING)
HCL PICKLE TANK
WATER SPRAYS 0.7 ℓ/SEC. (11 GPM)
RUNNING RINSE
HOT STANDING RINSE
HOT DIP GALV.
4
0.7 ℓ/SEC (11 GPM)
TERMINAL SETTLING LAGOON 46,200,000 ℓ (12,200,000 GAL.)
5
350 ℓ/SEC. (5556 GPM) TO RECEIVING STREAM
△ = SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
COMBINED WIRE, ROD, PICKLING & WIRE GALVANIZING LINES
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG. 6-24-74 REV.2 2-26-76
REV.1 2-20-76

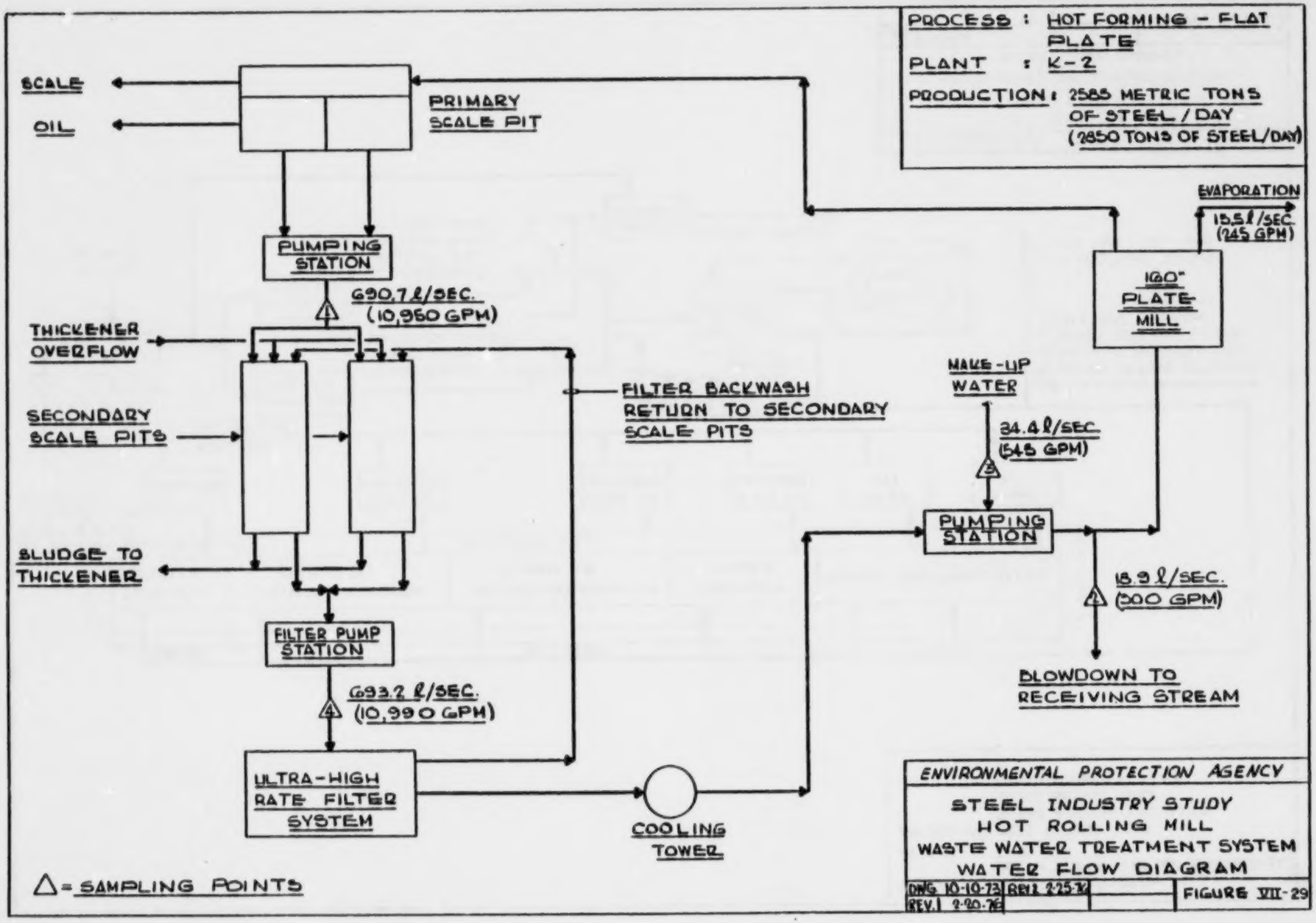
FIGURE VII-27


SERVICE WATER INTAKE
6
PUMPING STATION
ELEVATED STORAGE TANK
EMERGENCY WATER SUPPLY
NON-CONTACT
COOLING WATER
PROCESS: HOT FORMING-FLAT-HOT STRIP & SHEET
PLANT: J-2
PRODUCTION: 80" MILL 4463 METRIC TONS (4,920 TONS)/DAY
84" MILL 9251 METRIC TONS (10,200 TONS)/DAY
TOTAL 13,714 METRIC TONS (15,120 TONS)/DAY
84" MILL REHEAT FURNACES
84" MILL ROUGHING SECTION
84" MILL MOTOR ROOM & OIL SECTION
FLUME FLUSH
FLUME FLUSH
NON-CONTACT COOLING WATER
1893 ℓ/SEC. (30,000 GPM) [D.F.]
SECONDARY PITS
PRIMARY PIT
ROUGHING SCALE PIT
4
2725 ℓ/SEC (43,200 GPM) [M.F.]
TERMINAL TREATMENT
TOTAL MILL OILY WASTE WATERS
5
37.0 ℓ/SEC. (586 GPM) [M.F.]
FINISHING & ROUGHING PITS 80" MILL
RUN OUT TABLE 80" MILL
252 ℓ/SEC. (4,000 GPM) [D.F.] TO RECEIVING STREAM
TO RECEIVING STREAM
SAMPLING POINT
[D.F.] DESIGNED FLOW
[M.F.] MEASURED FLOW
84" MILL FINISHING SECTION
84" MILL RUNOUT TABLE
84" MILL COILERS
1136 ℓ/SEC (18,000 GPM) (D.F.)
FINISHING SCALE PIT
RUN OUT TABLE SCALE PIT
1
3
549 ℓ/SEC. (8,700 GPM) [M.F.]
EQUALIZATION TANK
POLYELECTROLYTE FEED SYSTEM
GRAVITY FILTERS
BACKWASH EFFLUENT
AIR
BACKWASH WATER
2
1640-2208 ℓ/SEC (26,000-35,000 GPM) [M.F.]
FILTRATE
CLARIFIER
SLUDGE
VACUUM FILTER
FILTRATION PLANT
TO LAND FILL
DWG. 11-9-73
REV 1 2-24-76

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT STRIP MILL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-28

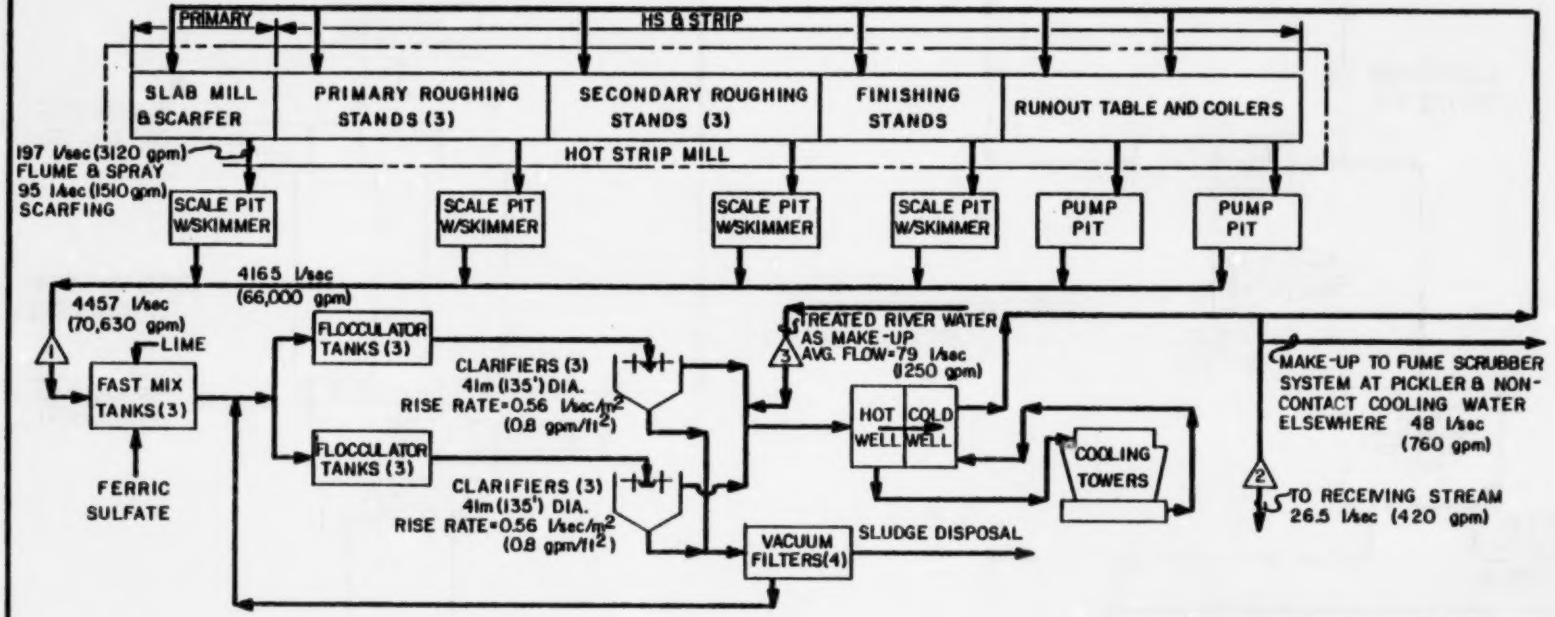

PROCESS : HOT FORMING - FLAT PLATE
PLANT : K-2
PRODUCTION : 2585 METRIC TONS OF STEEL / DAY (2850 TONS OF STEEL/DAY)
SCALE
OIL
PRIMARY SCALE PIT
PUMPING STATION
1
690.7 l/SEC. (10,950 GPM)
THICKENER OVERFLOW
SECONDARY SCALE PITS
SLUDGE TO THICKENER
FILTER PUMP STATION
4
693.2 l/SEC. (10,990 GPM)
ULTRA-HIGH RATE FILTER SYSTEM
FILTER BACKWASH RETURN TO SECONDARY SCALE PITS
COOLING TOWER
MAKE-UP WATER
3
34.4 l/SEC. (545 GPM)
PUMPING STATION
2
18.9 l/SEC. (300 GPM)
BLOWDOWN TO RECEIVING STREAM
160" PLATE MILL
EVAPORATION
15.5 l/SEC. (245 GPM)
△ = SAMPLING POINTS
DWG 10-10-73
REV.1 2-20-76
REV 2 2-25-76

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT ROLLING MILL
WASTE WATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-29

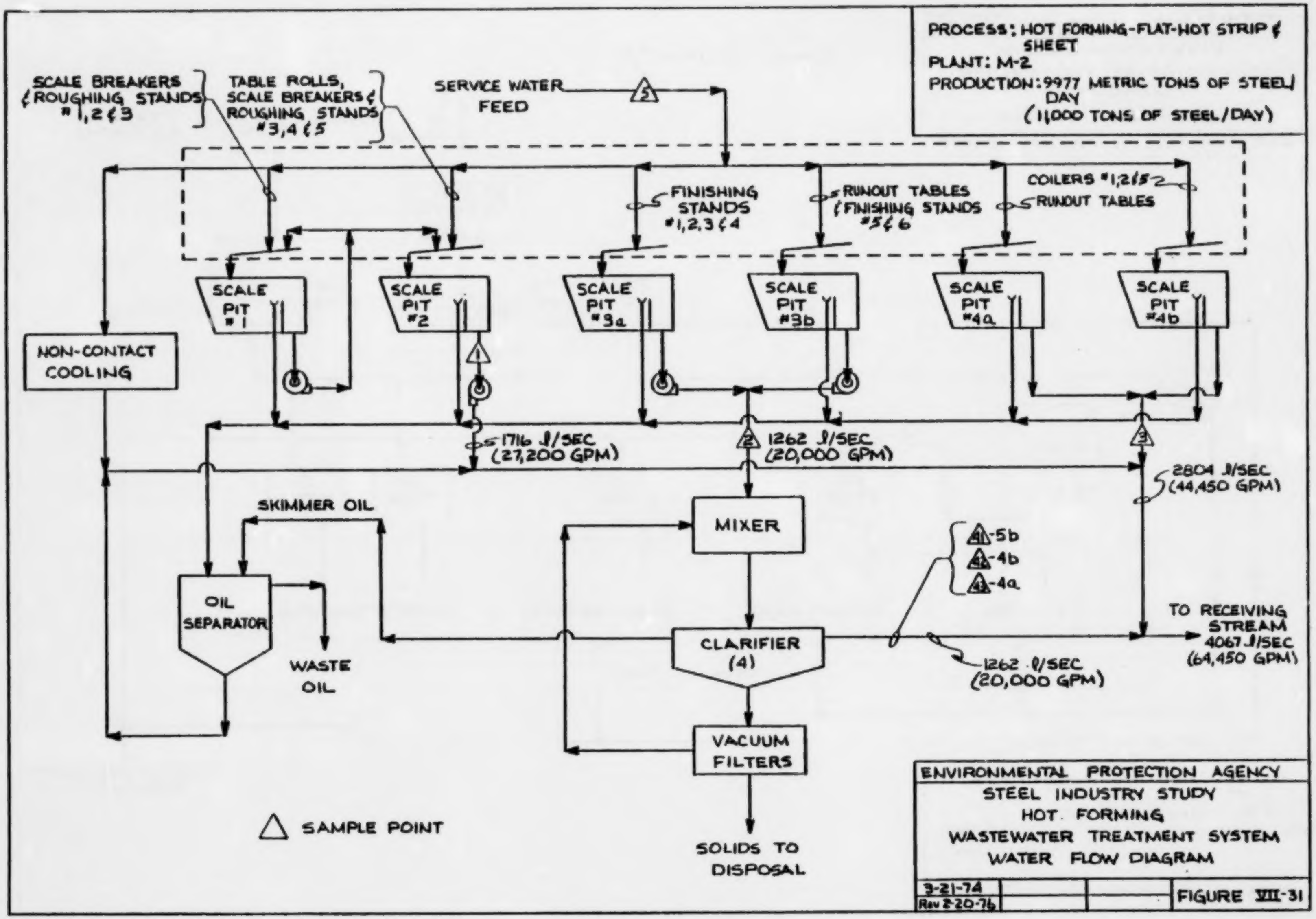
PROCESS: HOT FORMING - PRIMARY
HOT FORMING-FLAT-HOT STRIP & SHEET
PLANT: L-2
PRODUCTION: 9854 METRIC TONS
(10,864 TONS/DAY) PRIMARY
10,506 METRIC TONS
(11,583 TONS/DAY) FLAT

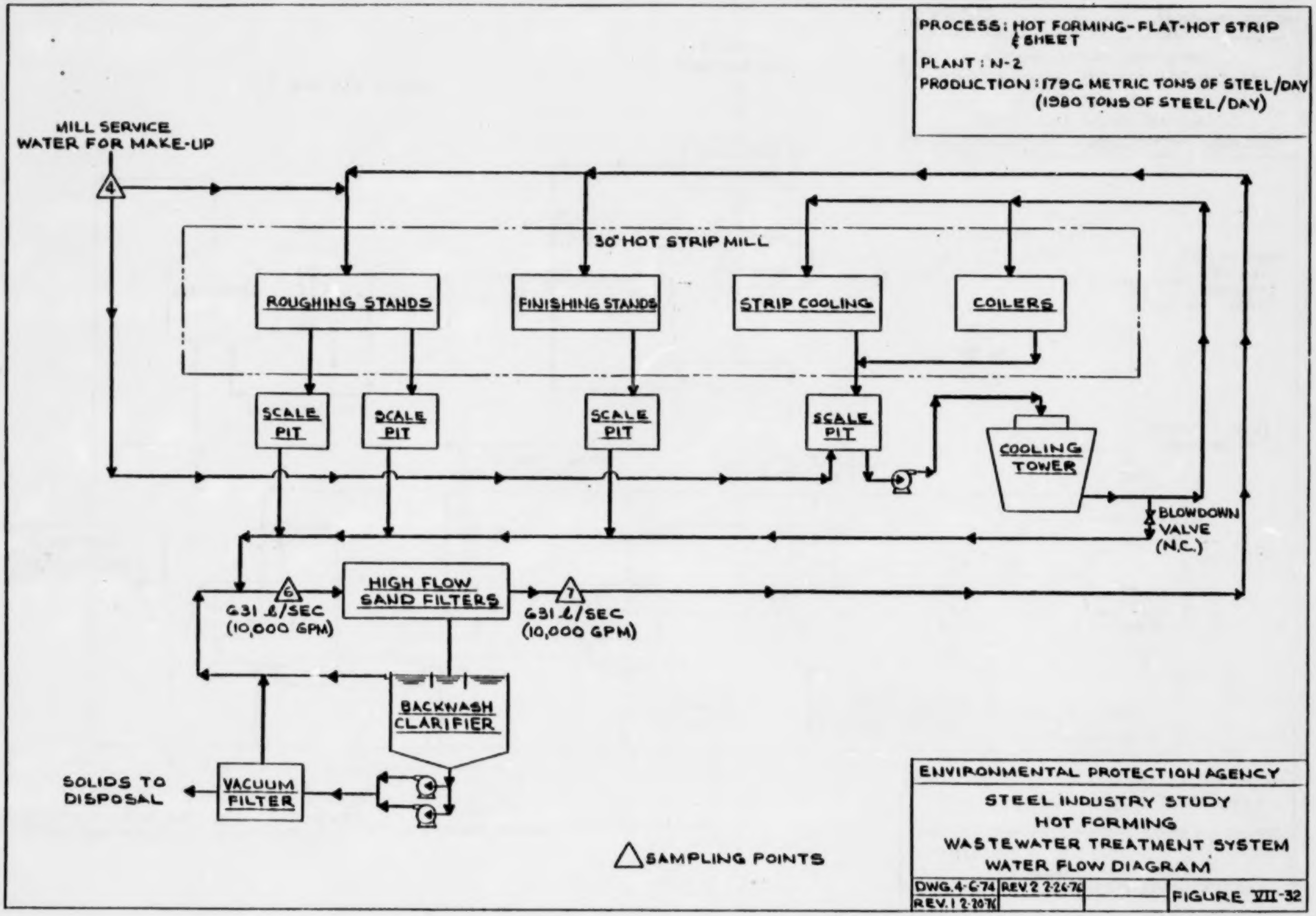

PRIMARY
HS & STRIP
SLAB MILL & SCARFER
PRIMARY ROUGHING STANDS (3)
SECONDARY ROUGHING STANDS (3)
FINISHING STANDS
RUNOUT TABLE AND COILERS
HOT STRIP MILL
197 l/sec (3120 gpm) FLUME & SPRAY
95 l/sec (1510 gpm) SCARFING
SCALE PIT W/SKIMMER
SCALE PIT W/SKIMMER
SCALE PIT W/SKIMMER
SCALE PIT W/SKIMMER
PUMP PIT
PUMP PIT
4165 l/sec (66,000 gpm)
4457 l/sec (70,630 gpm)
1
LIME
FAST MIX TANKS (3)
FERRIC SULFATE
FLOCCULATOR TANKS (3)
FLOCCULATOR TANKS (3)
CLARIFIERS (3) 41m (135') DIA. RISE RATE=0.56 l/sec/m² (0.8 gpm/ft²)
CLARIFIERS (3) 41m (135') DIA. RISE RATE=0.56 l/sec/m² (0.8 gpm/ft²)
3
TREATED RIVER WATER AS MAKE-UP AVG. FLOW=79 l/sec (1250 gpm)
HOT WELL
COLD WELL
COOLING TOWERS
VACUUM FILTERS (4)
SLUDGE DISPOSAL
MAKE-UP TO FUME SCRUBBER SYSTEM AT PICKLER & NON-CONTACT COOLING WATER ELSEWHERE 48 l/sec (760 gpm)
2
TO RECEIVING STREAM 26.5 l/sec (420 gpm)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

Dwn. 3/26/79

FIGURE VII-30


PROCESS: HOT FORMING-FLAT-HOT STRIP & SHEET
PLANT: M-2
PRODUCTION: 9977 METRIC TONS OF STEEL/DAY
(11,000 TONS OF STEEL/DAY)
SCALE BREAKERS & ROUGHING STANDS #1,2 & 3
TABLE ROLLS, SCALE BREAKERS & ROUGHING STANDS #3,4 & 5
SERVICE WATER FEED
5
FINISHING STANDS #1,2,3 & 4
RUNOUT TABLES & FINISHING STANDS #5 & 6
COILERS #1,2 & 5-2
RUNOUT TABLES
SCALE PIT #1
SCALE PIT #2
SCALE PIT #3a
SCALE PIT #3b
SCALE PIT #4a
SCALE PIT #4b
NON-CONTACT COOLING
1
1716 l/SEC (27,200 GPM)
2
1262 l/SEC (20,000 GPM)
3
2804 l/SEC (44,450 GPM)
SKIMMER OIL
MIXER
OIL SEPARATOR
WASTE OIL
4-5b
4-4b
4-4a
CLARIFIER (4)
1262 l/SEC (20,000 GPM)
TO RECEIVING STREAM 4067 l/SEC (64,450 GPM)
VACUUM FILTERS
SOLIDS TO DISPOSAL
△ SAMPLE POINT
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
3-21-74
Rev 2-20-76
FIGURE VII-31


MILL SERVICE WATER FOR MAKE-UP
4
30" HOT STRIP MILL
ROUGHING STANDS
FINISHING STANDS
STRIP COOLING
COILERS
SCALE PIT
SCALE PIT
SCALE PIT
SCALE PIT
COOLING TOWER
BLOWDOWN VALVE (N.C.)
6
631 ℓ/SEC (10,000 GPM)
HIGH FLOW SAND FILTERS
7
631 ℓ/SEC (10,000 GPM)
BACKWASH CLARIFIER
VACUUM FILTER
SOLIDS TO DISPOSAL
△ SAMPLING POINTS

PROCESS: HOT FORMING-FLAT-HOT STRIP & SHEET
PLANT: N-2
PRODUCTION: 1796 METRIC TONS OF STEEL/DAY
(1980 TONS OF STEEL/DAY)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

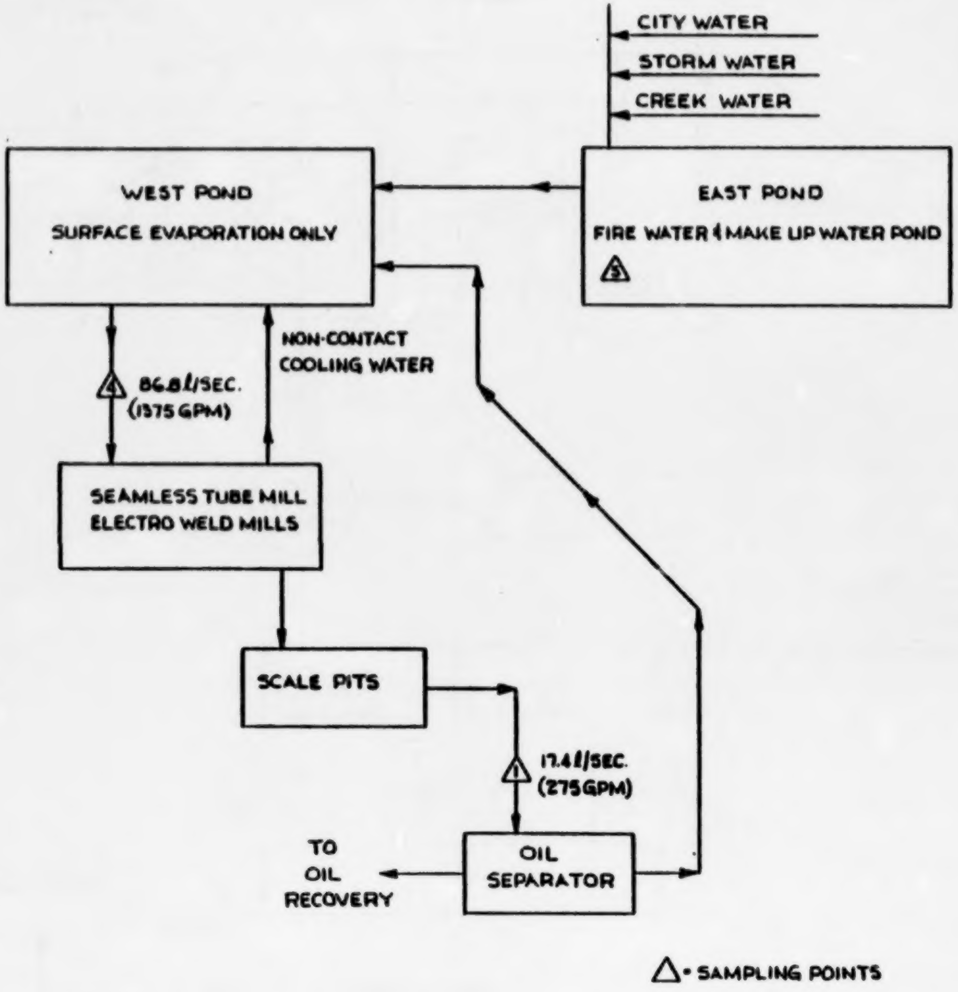
DWG. 4-6-74 REV. 2 2-26-76
REV. 1 2-20-76

FIGURE VII-32

PROCESS: PIPE & TUBES

PLANT: GG-2

PRODUCTION: 211 METRIC TONS OF STEEL/DAY
(233 TONS OF STEEL/DAY

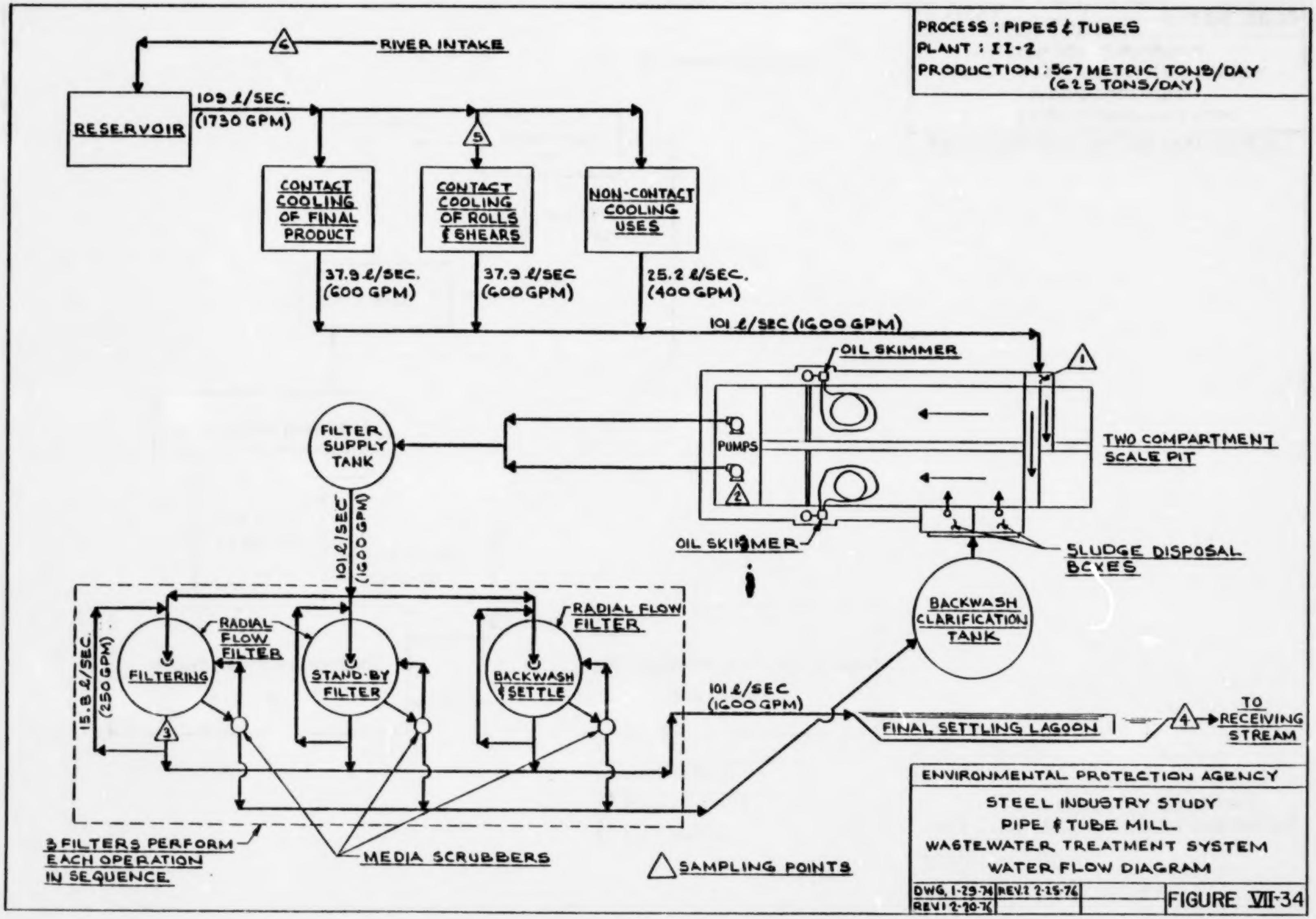

CITY WATER
STORM WATER
CREEK WATER
WEST POND
SURFACE EVAPORATION ONLY
EAST POND
FIRE WATER & MAKE UP WATER POND
5
4
86.8 l/SEC.
(1375 GPM)
NON-CONTACT
COOLING WATER
SEAMLESS TUBE MILL
ELECTRO WELD MILLS
SCALE PITS
1
17.4 l/SEC.
(275 GPM)
TO
OIL
RECOVERY
OIL
SEPARATOR
△ - SAMPLING POINTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
PIPE & TUBE MILL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWG. 5-6-74
REV 1 2-20-76
REV 2 2-26-76

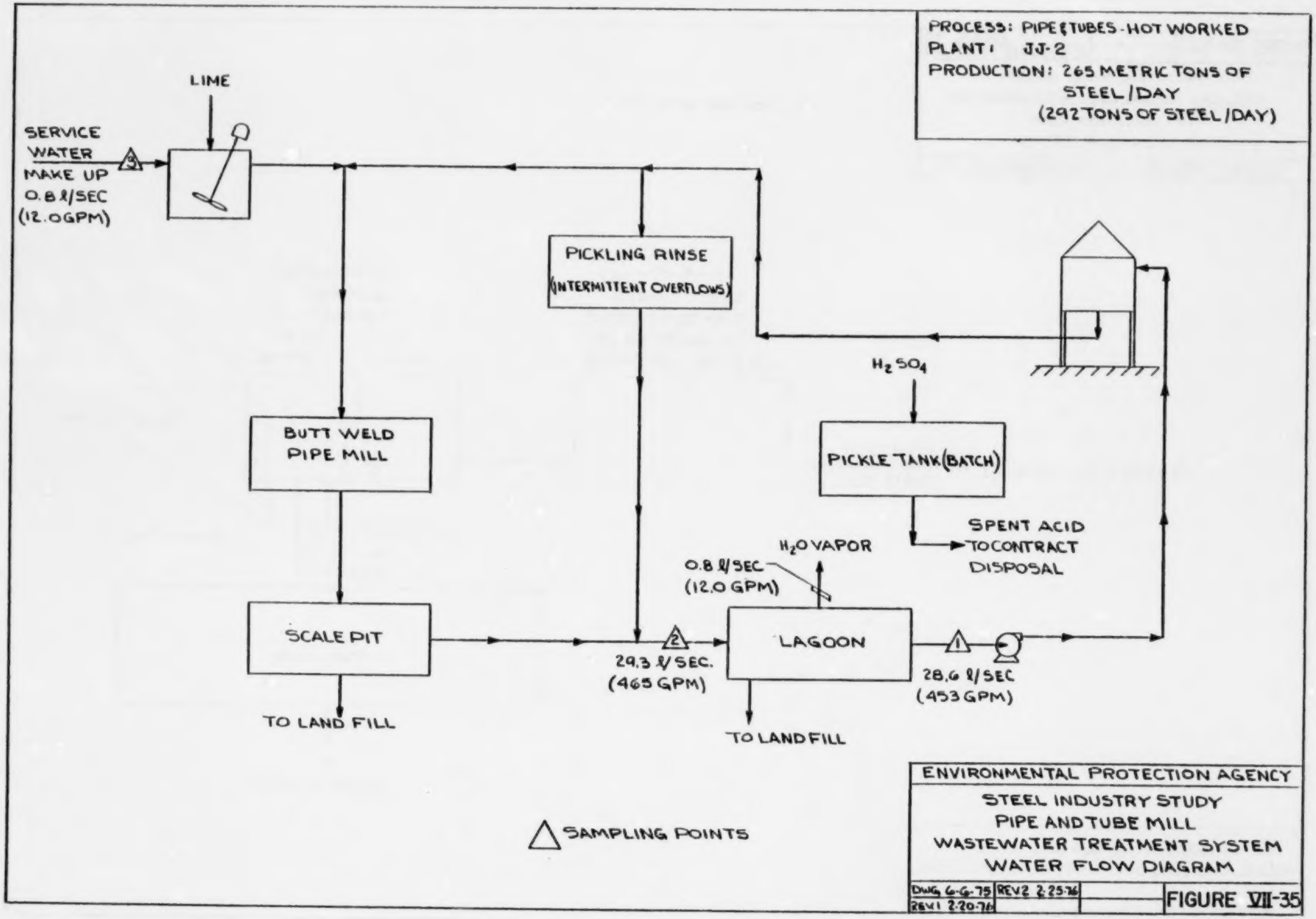
FIGURE VII-33


PROCESS : PIPES & TUBES
PLANT : II-2
PRODUCTION : 567 METRIC TONS/DAY (625 TONS/DAY)
6
RIVER INTAKE
RESERVOIR
109 ℓ/SEC. (1730 GPM)
5
CONTACT COOLING OF FINAL PRODUCT
CONTACT COOLING OF ROLLS & SHEARS
NON-CONTACT COOLING USES
37.9 ℓ/SEC. (600 GPM)
37.9 ℓ/SEC (600 GPM)
25.2 ℓ/SEC. (400 GPM)
101 ℓ/SEC (1600 GPM)
OIL SKIMMER
1
TWO COMPARTMENT SCALE PIT
PUMPS
2
OIL SKIMMER
SLUDGE DISPOSAL BOXES
FILTER SUPPLY TANK
101 ℓ/SEC (1600 GPM)
BACKWASH CLARIFICATION TANK
15.8 ℓ/SEC. (250 GPM)
FILTERING
RADIAL FLOW FILTER
3
STAND-BY FILTER
RADIAL FLOW FILTER
BACKWASH & SETTLE
RADIAL FLOW FILTER
101 ℓ/SEC (1600 GPM)
FINAL SETTLING LAGOON
4
TO RECEIVING STREAM
3 FILTERS PERFORM EACH OPERATION IN SEQUENCE
MEDIA SCRUBBERS
SAMPLING POINTS
DWG. 1-29-74
REV 1 2-20-76
REV 2 2-25-76

ENVIRONMENTAL PROTECTION AGENCY

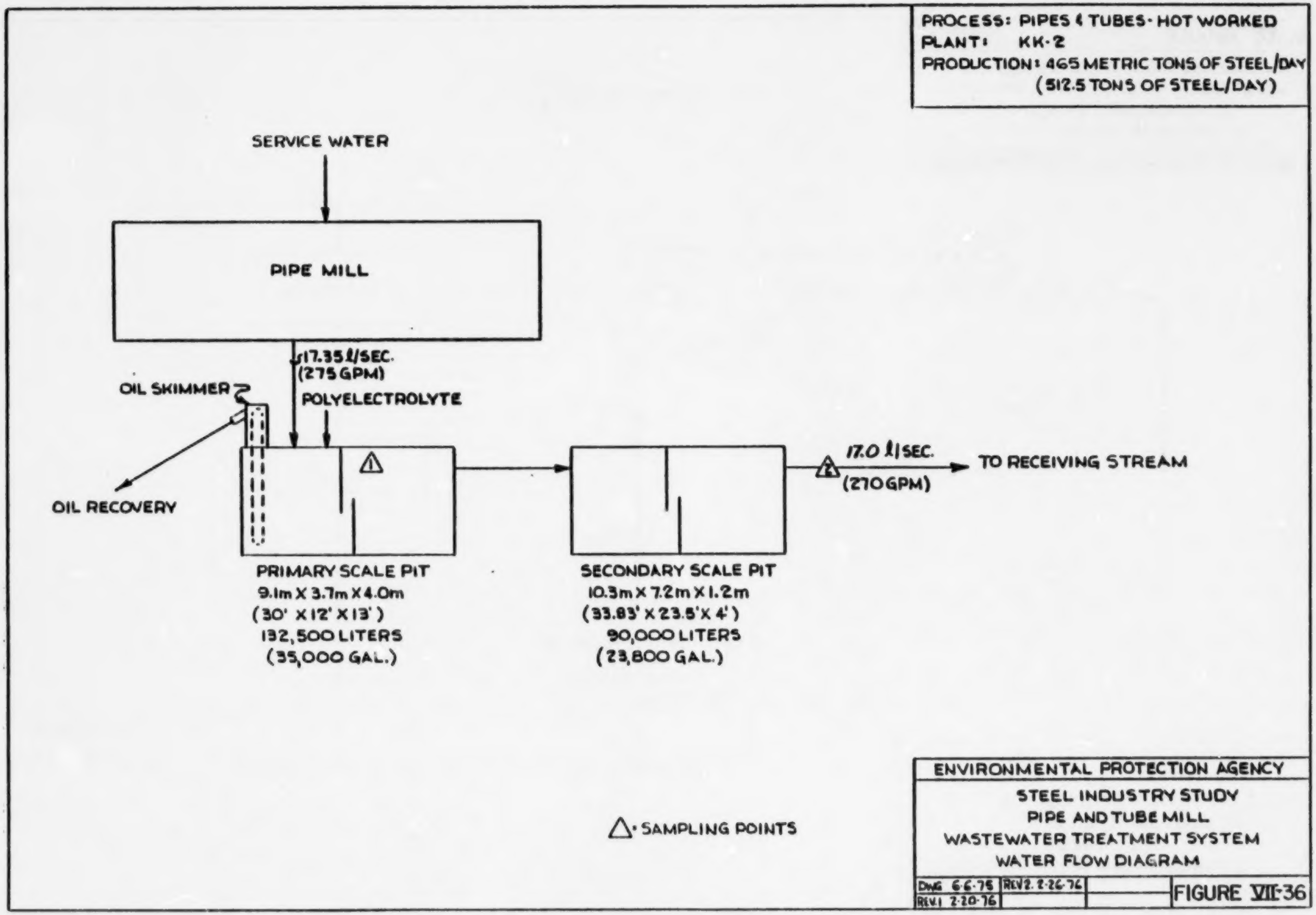
STEEL INDUSTRY STUDY
PIPE & TUBE MILL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-34


PROCESS: PIPE & TUBES - HOT WORKED
PLANT: JJ-2
PRODUCTION: 265 METRIC TONS OF STEEL/DAY (292 TONS OF STEEL/DAY)
LIME
SERVICE WATER MAKE UP
3
0.8 l/SEC (12.0GPM)
PICKLING RINSE (INTERMITTENT OVERFLOWS)
BUTT WELD PIPE MILL
H_2SO_4
PICKLE TANK (BATCH)
SPENT ACID TO CONTRACT DISPOSAL
H_2O VAPOR
0.8 l/SEC (12.0 GPM)
SCALE PIT
2
29.3 l/SEC. (465 GPM)
LAGOON
1
28.6 l/SEC (453 GPM)
TO LAND FILL
TO LANDFILL
SAMPLING POINTS
DWG 6-6-75
REV 1 2-20-76
REV 2 2-25-76

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
PIPE AND TUBE MILL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

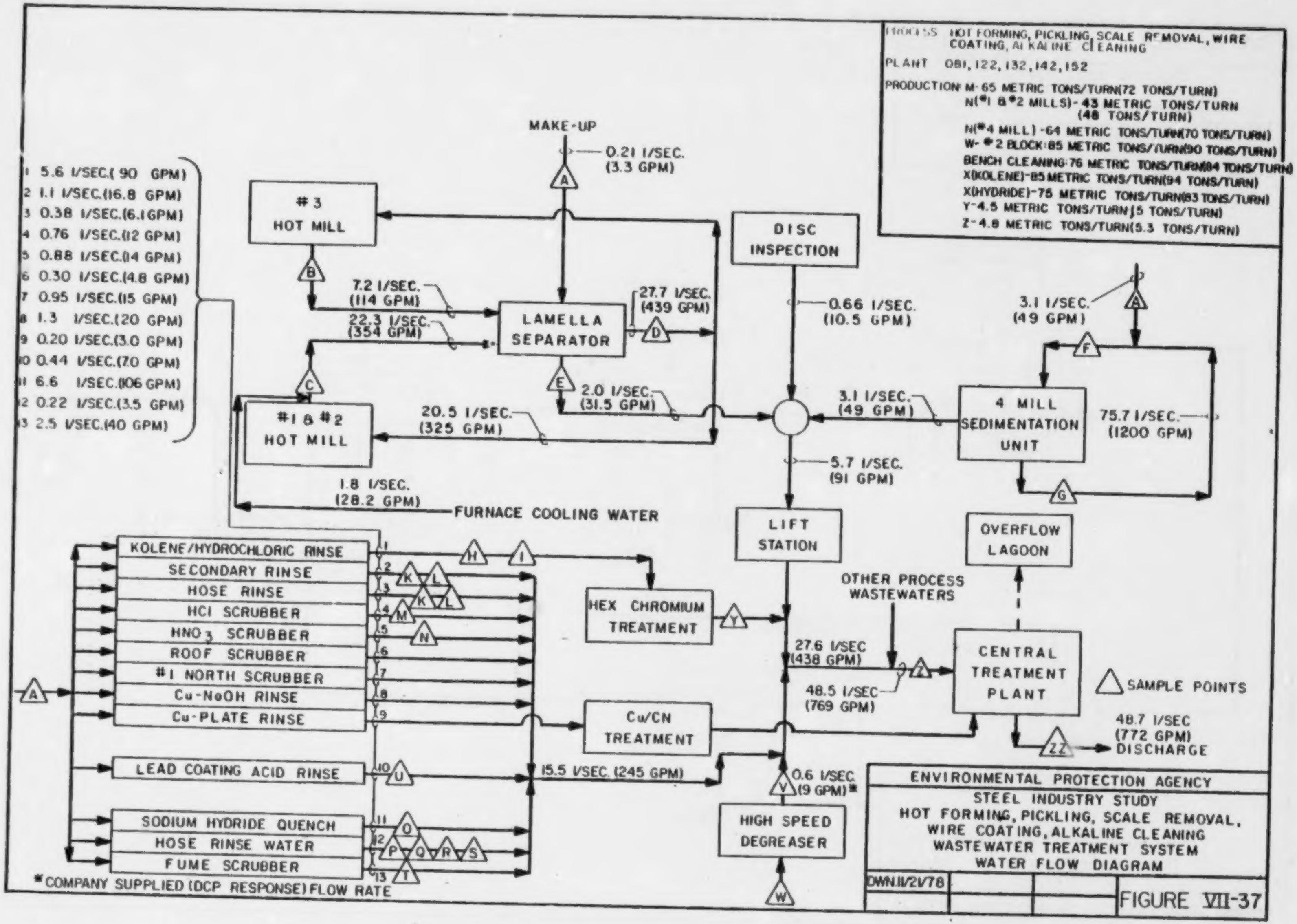
FIGURE VII-35


SERVICE WATER
PIPE MILL
17.35 ℓ/SEC.
(275 GPM)
OIL SKIMMER
POLYELECTROLYTE
OIL RECOVERY
PRIMARY SCALE PIT
9.1m X 3.7m X 4.0m
(30' X 12' X 13')
132,500 LITERS
(35,000 GAL.)
SECONDARY SCALE PIT
10.3m X 7.2m X 1.2m
(33.83' X 23.5' X 4')
90,000 LITERS
(23,800 GAL.)
17.0 ℓ/SEC.
(270 GPM)
TO RECEIVING STREAM
△: SAMPLING POINTS
DWG 6-6-75
REV 1 2-20-76
REV 2 2-26-76

PROCESS: PIPES & TUBES - HOT WORKED
PLANT: KK-2
PRODUCTION: 465 METRIC TONS OF STEEL/DAY
(512.5 TONS OF STEEL/DAY)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
PIPE AND TUBE MILL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-36



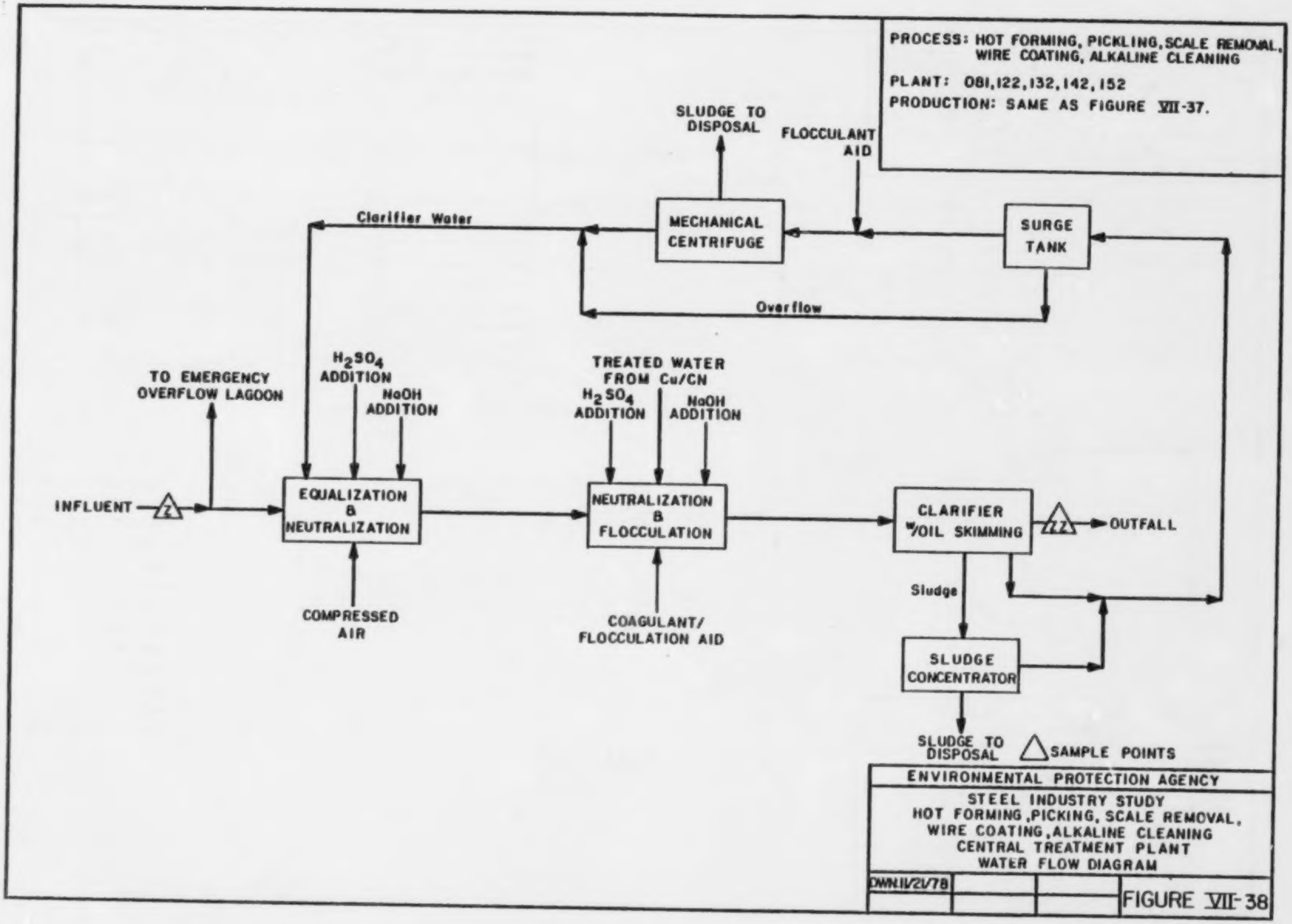
ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING, PICKLING, SCALE REMOVAL,
WIRE COATING, ALKALINE CLEANING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN.11/21/78

FIGURE VII-37

PROCESS HOT FORMING, PICKLING, SCALE REMOVAL, WIRE COATING, ALKALINE CLEANING
PLANT 081, 122, 132, 142, 152
PRODUCTION: M-65 METRIC TONS/TURN(72 TONS/TURN)
N(#1 & #2 MILLS)-43 METRIC TONS/TURN (48 TONS/TURN)
N(#4 MILL)-64 METRIC TONS/TURN(70 TONS/TURN)
W- #2 BLOCK:85 METRIC TONS/TURN(90 TONS/TURN)
BENCH CLEANING:76 METRIC TONS/TURN(84 TONS/TURN)
X(KOLENE)-85 METRIC TONS/TURN(94 TONS/TURN)
X(HYDRIDE)-75 METRIC TONS/TURN(83 TONS/TURN)
Y-4.5 METRIC TONS/TURN(5 TONS/TURN)
Z-4.8 METRIC TONS/TURN(5.3 TONS/TURN)
1 5.6 l/SEC.(90 GPM)
2 1.1 l/SEC.(16.8 GPM)
3 0.38 l/SEC.(6.1 GPM)
4 0.76 l/SEC.(12 GPM)
5 0.88 l/SEC.(14 GPM)
6 0.30 l/SEC.(4.8 GPM)
7 0.95 l/SEC.(15 GPM)
8 1.3 l/SEC.(20 GPM)
9 0.20 l/SEC.(3.0 GPM)
10 0.44 l/SEC.(7.0 GPM)
11 6.6 l/SEC.(106 GPM)
12 0.22 l/SEC.(3.5 GPM)
13 2.5 l/SEC.(40 GPM)
MAKE-UP
0.21 l/SEC. (3.3 GPM)
A
#3 HOT MILL
B
7.2 l/SEC. (114 GPM)
22.3 l/SEC. (354 GPM)
LAMELLA SEPARATOR
27.7 l/SEC. (439 GPM)
D
E
2.0 l/SEC. (31.5 GPM)
C
#1 & #2 HOT MILL
20.5 l/SEC. (325 GPM)
1.8 l/SEC. (28.2 GPM)
FURNACE COOLING WATER
DISC INSPECTION
0.66 l/SEC. (10.5 GPM)
3.1 l/SEC. (49 GPM)
A
F
4 MILL SEDIMENTATION UNIT
3.1 l/SEC. (49 GPM)
75.7 l/SEC. (1200 GPM)
G
5.7 l/SEC. (91 GPM)
LIFT STATION
OVERFLOW LAGOON
KOLENE/HYDROCHLORIC RINSE
SECONDARY RINSE
HOSE RINSE
HCl SCRUBBER
HNO3 SCRUBBER
ROOF SCRUBBER
#1 NORTH SCRUBBER
Cu-NaOH RINSE
Cu-PLATE RINSE
LEAD COATING ACID RINSE
SODIUM HYDRIDE QUENCH
HOSE RINSE WATER
FUME SCRUBBER
1
2
3
4
5
6
7
8
9
10
11
12
13
H
I
K
L
K
L
M
N
U
O
P
Q
R
S
T
HEX CHROMIUM TREATMENT
Y
Cu/CN TREATMENT
15.5 l/SEC. (245 GPM)
OTHER PROCESS WASTEWATERS
27.6 l/SEC (438 GPM)
Z
48.5 l/SEC (769 GPM)
CENTRAL TREATMENT PLANT
SAMPLE POINTS
48.7 l/SEC (772 GPM) DISCHARGE
ZZ
V
0.6 l/SEC. (9 GPM)*
HIGH SPEED DEGREASER
W
*COMPANY SUPPLIED (DCP RESPONSE) FLOW RATE



PROCESS: HOT FORMING, PICKLING, SCALE REMOVAL, WIRE COATING, ALKALINE CLEANING

PLANT: 081, 122, 132, 142, 152

PRODUCTION: SAME AS FIGURE VII-37.

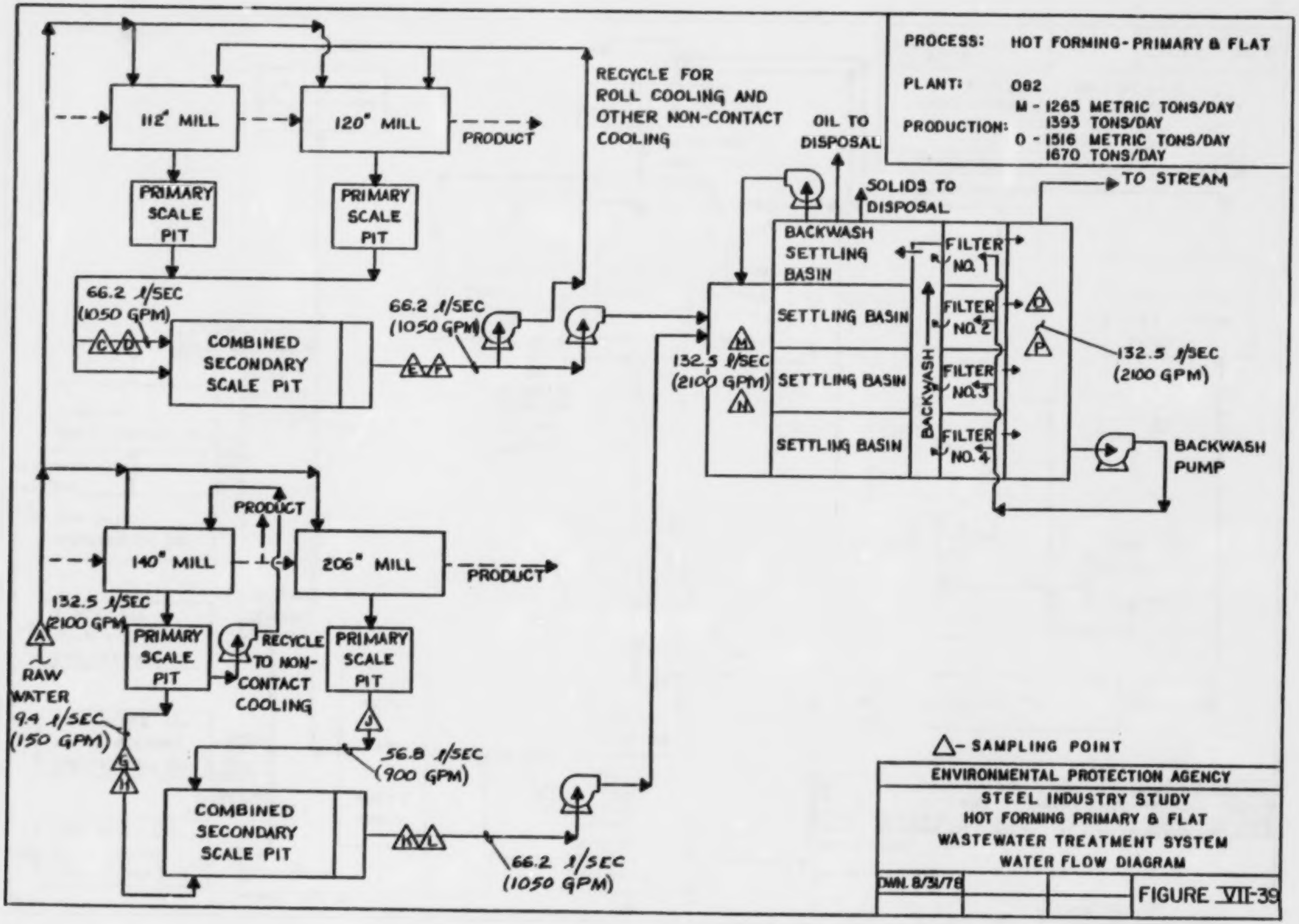
INFLUENT
Z
TO EMERGENCY OVERFLOW LAGOON
EQUALIZATION & NEUTRALIZATION
H_2SO_4 ADDITION
NaOH ADDITION
COMPRESSED AIR
Clarifier Water
MECHANICAL CENTRIFUGE
SLUDGE TO DISPOSAL
FLOCCULANT AID
SURGE TANK
Overflow
TREATED WATER FROM Cu/CN
H_2SO_4 ADDITION
NaOH ADDITION
NEUTRALIZATION & FLOCCULATION
COAGULANT/ FLOCCULATION AID
CLARIFIER W/OIL SKIMMING
ZZ
OUTFALL
Sludge
SLUDGE CONCENTRATOR
SLUDGE TO DISPOSAL
SAMPLE POINTS

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING, PICKING, SCALE REMOVAL,
WIRE COATING, ALKALINE CLEANING
CENTRAL TREATMENT PLANT
WATER FLOW DIAGRAM

DWN.11/21/78

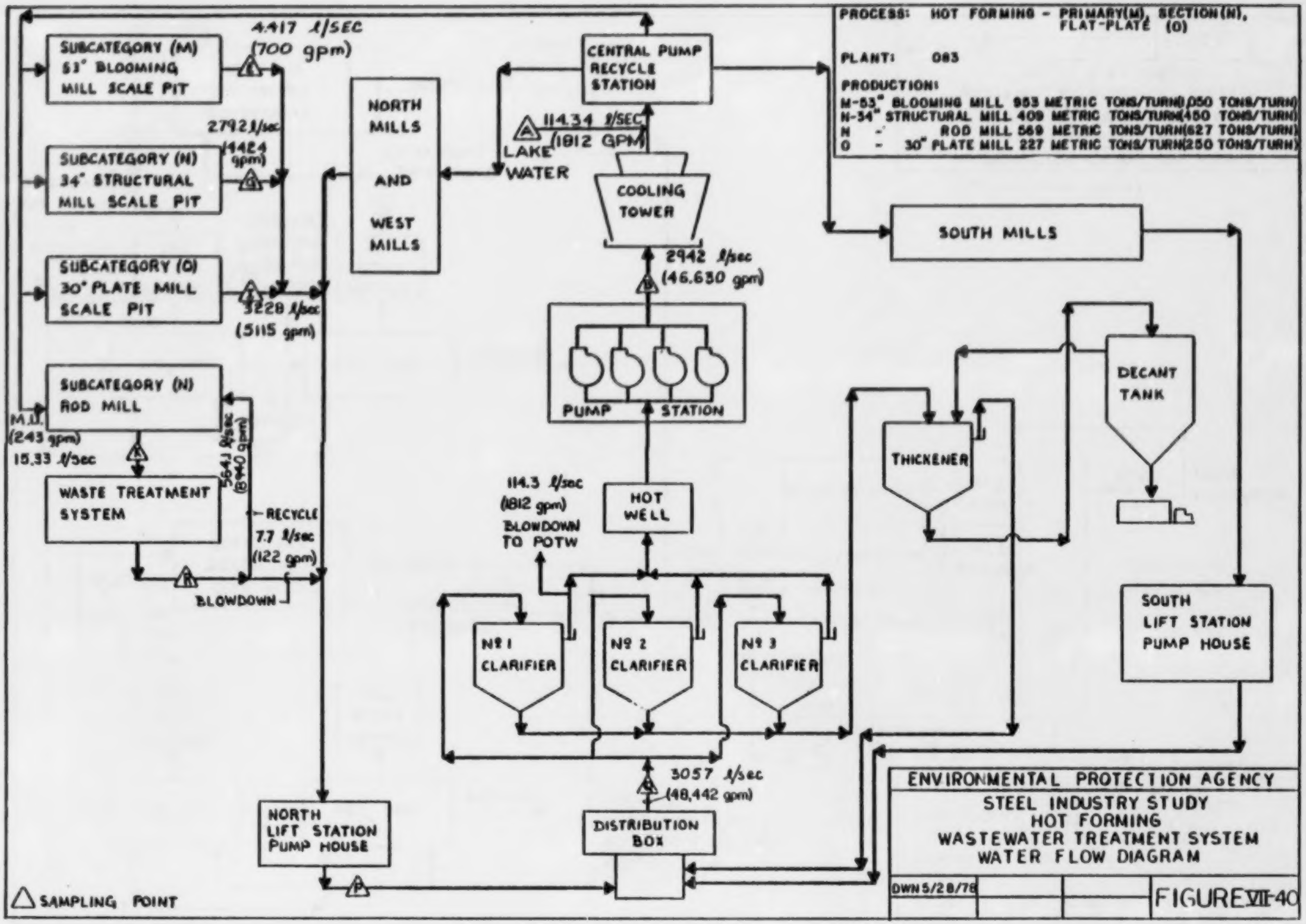
FIGURE VII-38


PROCESS: HOT FORMING-PRIMARY & FLAT
PLANT: 082
PRODUCTION: M - 1265 METRIC TONS/DAY 1393 TONS/DAY
0 - 1516 METRIC TONS/DAY 1670 TONS/DAY
112" MILL
120" MILL
PRODUCT
PRIMARY SCALE PIT
PRIMARY SCALE PIT
66.2 l/SEC (1050 GPM)
C
D
COMBINED SECONDARY SCALE PIT
E
F
66.2 l/SEC (1050 GPM)
RECYCLE FOR ROLL COOLING AND OTHER NON-CONTACT COOLING
OIL TO DISPOSAL
SOLIDS TO DISPOSAL
TO STREAM
BACKWASH SETTLING BASIN
SETTLING BASIN
SETTLING BASIN
SETTLING BASIN
BACKWASH
FILTER NO. 1
FILTER NO. 2
FILTER NO. 3
FILTER NO. 4
M
N
132.5 l/SEC (2100 GPM)
O
P
132.5 l/SEC (2100 GPM)
BACKWASH PUMP
140" MILL
206" MILL
PRODUCT
PRODUCT
132.5 l/SEC (2100 GPM)
A
RAW WATER
9.4 l/SEC (150 GPM)
PRIMARY SCALE PIT
RECYCLE TO NON-CONTACT COOLING
PRIMARY SCALE PIT
J
56.8 l/SEC (900 GPM)
G
H
COMBINED SECONDARY SCALE PIT
K
L
66.2 l/SEC (1050 GPM)
△- SAMPLING POINT
DWN. 8/31/78

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING PRIMARY & FLAT
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-39


SUBCATEGORY (M) 53" BLOOMING MILL SCALE PIT
4.417 l/SEC (700 gpm)
SUBCATEGORY (N) 34" STRUCTURAL MILL SCALE PIT
2792 l/sec (4424 gpm)
SUBCATEGORY (O) 30" PLATE MILL SCALE PIT
3228 l/sec (5115 gpm)
SUBCATEGORY (N) ROD MILL
M.U. (243 gpm) 15.33 l/sec
5641 l/sec (8940 gpm)
WASTE TREATMENT SYSTEM
RECYCLE 7.7 l/sec (122 gpm)
BLOWDOWN
NORTH MILLS AND WEST MILLS
NORTH LIFT STATION PUMP HOUSE
CENTRAL PUMP RECYCLE STATION
114.34 l/SEC (1812 GPM)
LAKE WATER
COOLING TOWER
2942 l/sec (46,630 gpm)
PUMP STATION
HOT WELL
114.3 l/sec (1812 gpm) BLOWDOWN TO POTW
Nº 1 CLARIFIER
Nº 2 CLARIFIER
Nº 3 CLARIFIER
3057 l/sec (48,442 gpm)
DISTRIBUTION BOX
SOUTH MILLS
THICKENER
DECANT TANK
SOUTH LIFT STATION PUMP HOUSE
△ SAMPLING POINT
DWN 5/28/78

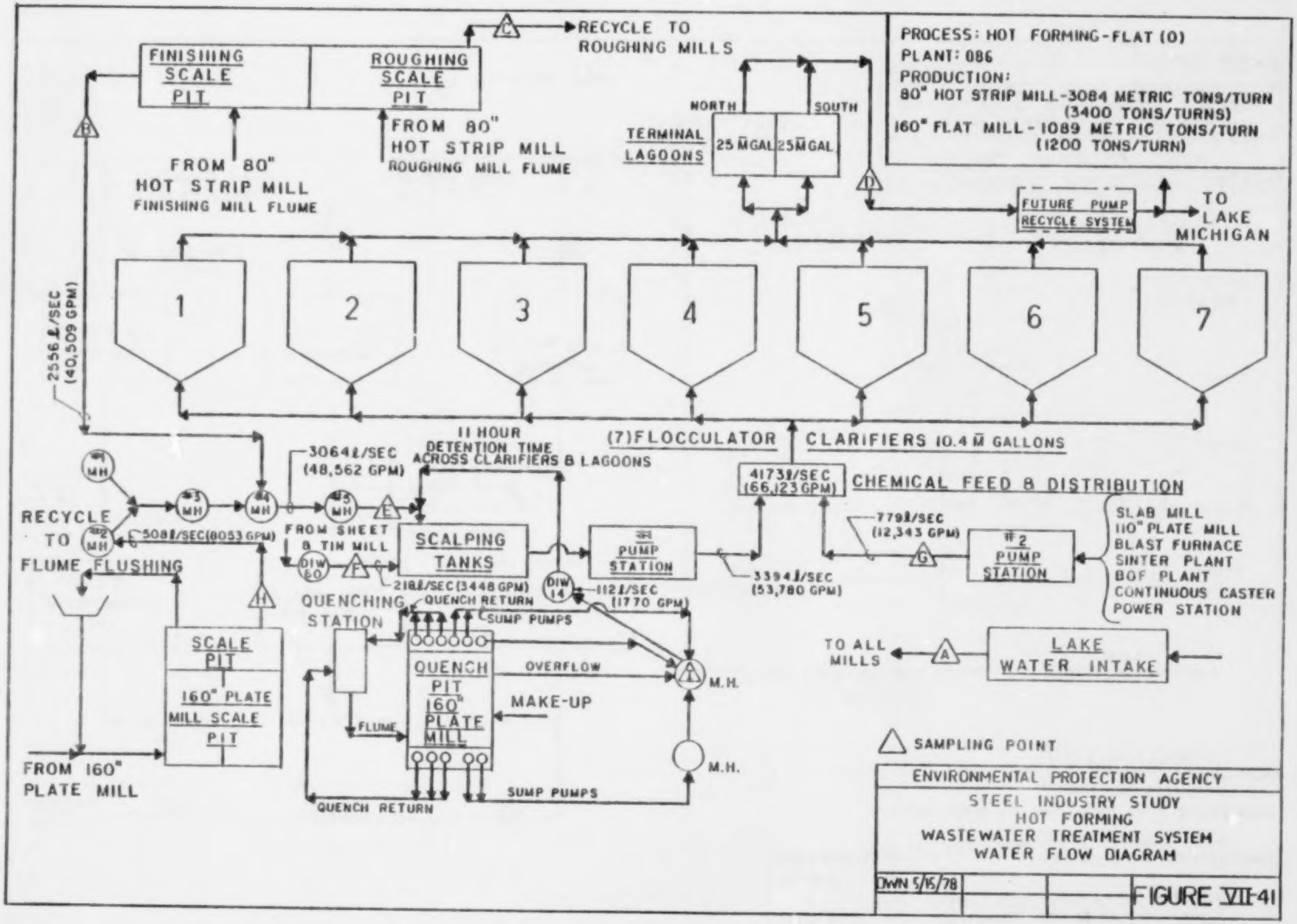
PROCESS: HOT FORMING - PRIMARY(M), SECTION(N), FLAT-PLATE (O)

PLANT: 083

PRODUCTION:
M-53" BLOOMING MILL 953 METRIC TONS/TURN(1,050 TONS/TURN)
N-34" STRUCTURAL MILL 409 METRIC TONS/TURN(450 TONS/TURN)
N - ROD MILL 569 METRIC TONS/TURN(627 TONS/TURN)
O - 30" PLATE MILL 227 METRIC TONS/TURN(250 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-40



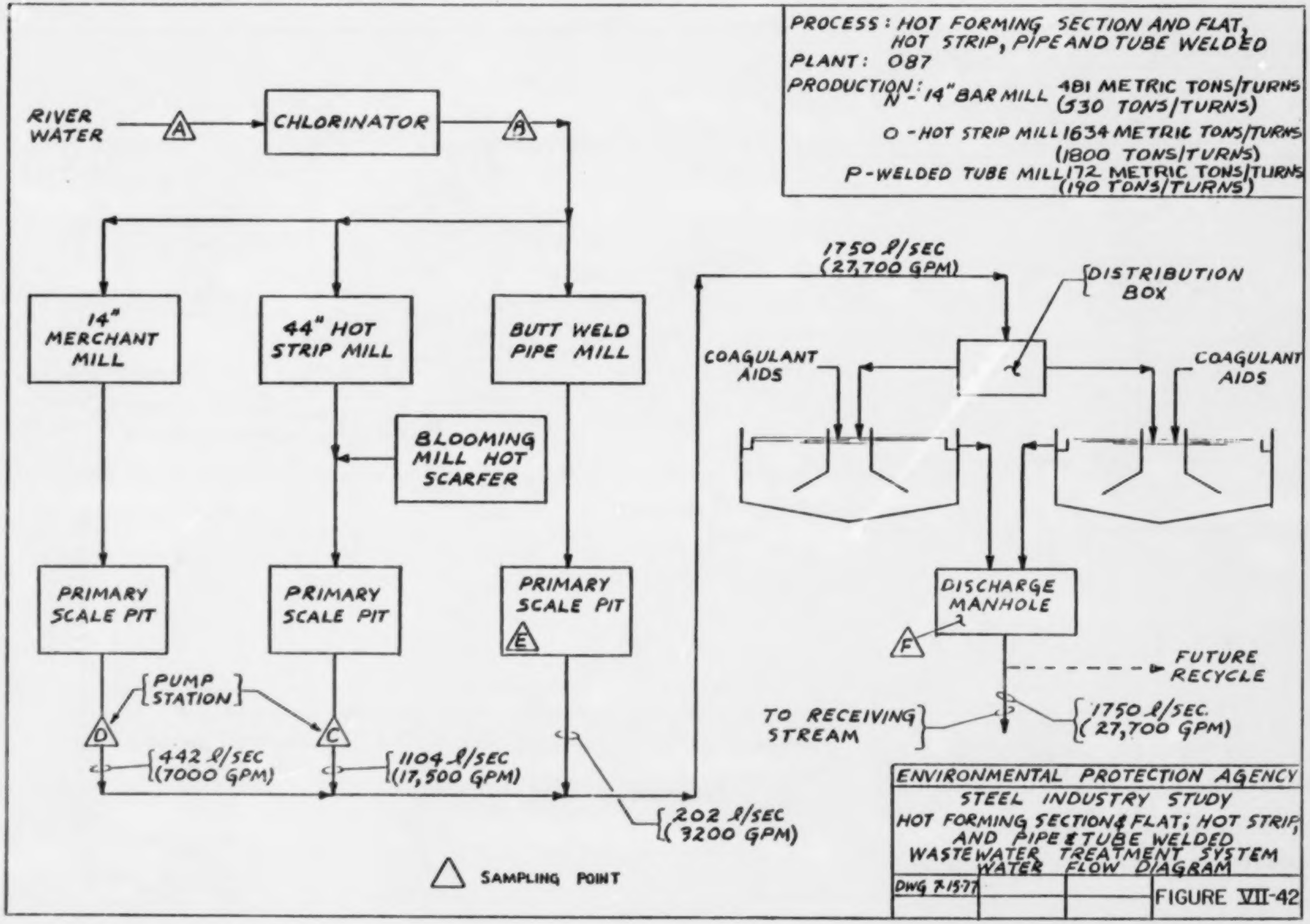
PROCESS: HOT FORMING-FLAT (O)
PLANT: 086
PRODUCTION:
80" HOT STRIP MILL-3084 METRIC TONS/TURN (3400 TONS/TURNS)
160" FLAT MILL-1089 METRIC TONS/TURN (1200 TONS/TURN)

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN 5/15/78

FIGURE VII-41

FINISHING SCALE PIT
ROUGHING SCALE PIT
C
RECYCLE TO ROUGHING MILLS
B
FROM 80" HOT STRIP MILL FINISHING MILL FLUME
FROM 80" HOT STRIP MILL ROUGHING MILL FLUME
NORTH
SOUTH
TERMINAL LAGOONS
25 M GAL
25 M GAL
D
FUTURE PUMP RECYCLE SYSTEM
TO LAKE MICHIGAN
1
2
3
4
5
6
7
2556 ℓ/SEC (40,509 GPM)
11 HOUR DETENTION TIME ACROSS CLARIFIERS & LAGOONS
(7) FLOCCULATOR
CLARIFIERS 10.4 M GALLONS
#1 MH
#2 MH
#3 MH
#4 MH
#5 MH
3064 ℓ/SEC (48,562 GPM)
E
RECYCLE TO FLUME FLUSHING
508 ℓ/SEC (8053 GPM)
FROM SHEET & TIN MILL
DIW 60
F
218 ℓ/SEC (3448 GPM)
SCALPING TANKS
DIW 14
112 ℓ/SEC (1770 GPM)
#1 PUMP STATION
3394 ℓ/SEC (53,780 GPM)
4173 ℓ/SEC (66,123 GPM)
CHEMICAL FEED & DISTRIBUTION
779 ℓ/SEC (12,343 GPM)
G
#2 PUMP STATION
SLAB MILL
110" PLATE MILL
BLAST FURNACE
SINTER PLANT
BOF PLANT
CONTINUOUS CASTER
POWER STATION
H
SCALE PIT
160" PLATE MILL SCALE PIT
QUENCHING STATION
QUENCH RETURN
SUMP PUMPS
QUENCH PIT 160" PLATE MILL
OVERFLOW
MAKE-UP
FLUME
I
M.H.
M.H.
SUMP PUMPS
QUENCH RETURN
FROM 160" PLATE MILL
TO ALL MILLS
A
LAKE WATER INTAKE
SAMPLING POINT


PROCESS: HOT FORMING SECTION AND FLAT, HOT STRIP, PIPE AND TUBE WELDED
PLANT: 087
PRODUCTION: N - 14" BAR MILL 481 METRIC TONS/TURNS (530 TONS/TURNS)
O - HOT STRIP MILL 1634 METRIC TONS/TURNS (1800 TONS/TURNS)
P - WELDED TUBE MILL 172 METRIC TONS/TURNS (190 TONS/TURNS)
RIVER WATER
A
CHLORINATOR
B
14" MERCHANT MILL
44" HOT STRIP MILL
BUTT WELD PIPE MILL
BLOOMING MILL HOT SCARFER
PRIMARY SCALE PIT
PRIMARY SCALE PIT
PRIMARY SCALE PIT
E
PUMP STATION
D
C
442 ℓ/SEC (7000 GPM)
1104 ℓ/SEC (17,500 GPM)
202 ℓ/SEC (3200 GPM)
1750 ℓ/SEC (27,700 GPM)
DISTRIBUTION BOX
COAGULANT AIDS
COAGULANT AIDS
DISCHARGE MANHOLE
F
FUTURE RECYCLE
TO RECEIVING STREAM
1750 ℓ/SEC. (27,700 GPM)
SAMPLING POINT
DWG 7-1577

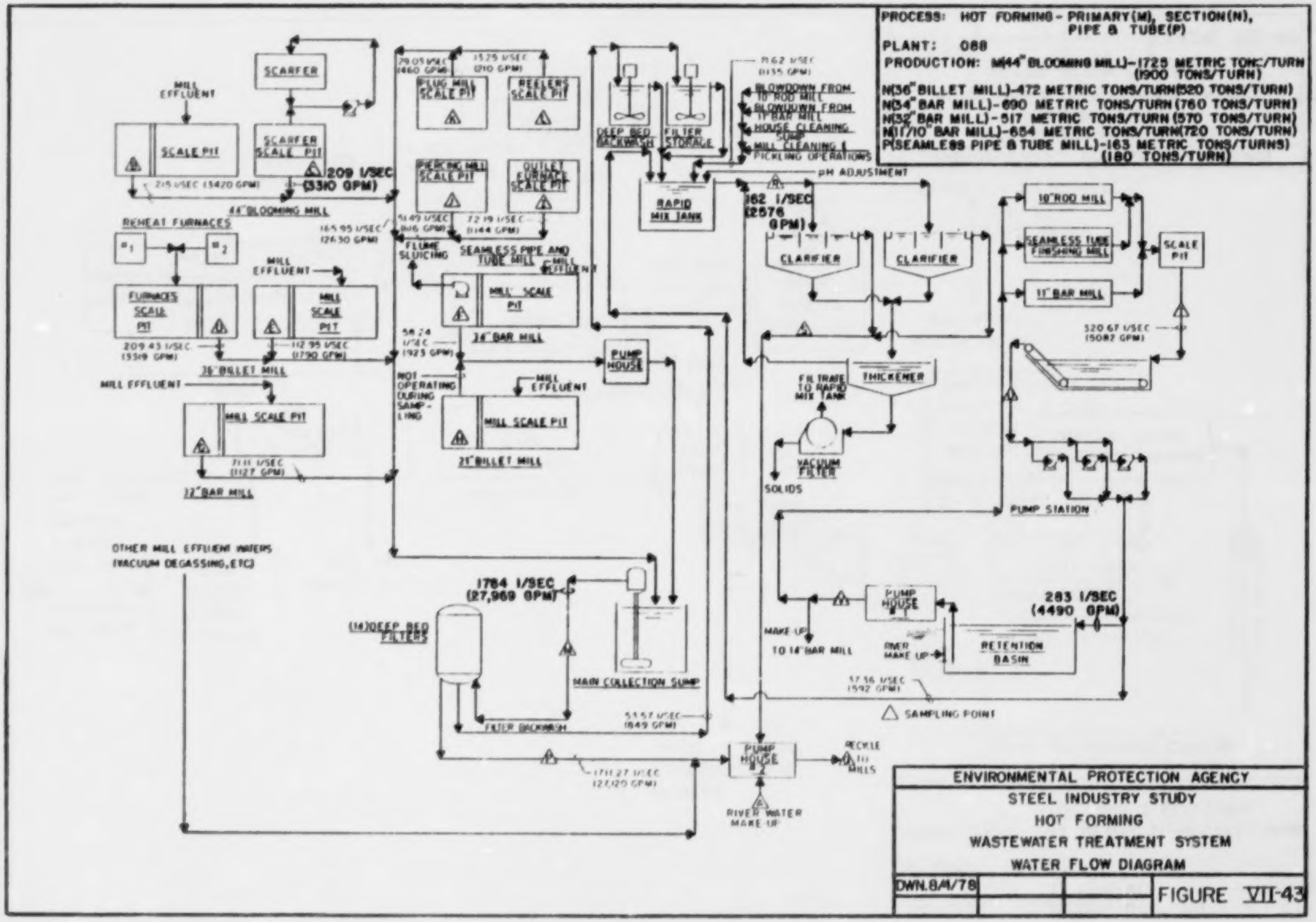
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING SECTION & FLAT; HOT STRIP, AND PIPE & TUBE WELDED
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

FIGURE VII-42

PROCESS: HOT FORMING - PRIMARY(M), SECTION(N),
PIPE & TUBE(P)

PLANT: 088

PRODUCTION: M(44" BLOOMING MILL)-1725 METRIC TONS/TURN
(1900 TONS/TURN)
N(36" BILLET MILL)-472 METRIC TONS/TURN(520 TONS/TURN)
N(34" BAR MILL)-690 METRIC TONS/TURN (760 TONS/TURN)
N(32" BAR MILL)-517 METRIC TONS/TURN (570 TONS/TURN)
N(11"/10" BAR MILL)-654 METRIC TONS/TURN(720 TONS/TURN)
P(SEAMLESS PIPE & TUBE MILL)-163 METRIC TONS/TURNS)
(180 TONS/TURN)


MILL EFFLUENT
SCALE PIT
215 l/SEC (3420 GPM)
SCARFER
SCARFER SCALE PIT
209 l/SEC (3310 GPM)
44" BLOOMING MILL
REHEAT FURNACES
#1
#2
FURNACES SCALE PIT
MILL EFFLUENT
MILL SCALE PIT
209.43 l/SEC (3319 GPM)
112.95 l/SEC (1790 GPM)
36" BILLET MILL
MILL EFFLUENT
MILL SCALE PIT
71.11 l/SEC (1127 GPM)
32" BAR MILL
OTHER MILL EFFLUENT WATERS
(VACUUM DEGASSING, ETC)
29.03 l/SEC (460 GPM)
13.25 l/SEC (210 GPM)
PLUG MILL SCALE PIT
REELERS SCALE PIT
PIERCING MILL SCALE PIT
OUTLET FURNACE SCALE PIT
165.95 l/SEC (2630 GPM)
51.49 l/SEC (816 GPM)
72.19 l/SEC (1144 GPM)
FLUME SLUICING
SEAMLESS PIPE AND TUBE MILL
MILL EFFLUENT
MILL SCALE PIT
58.24 l/SEC (923 GPM)
34" BAR MILL
NOT OPERATING DURING SAMPLING
MILL EFFLUENT
MILL SCALE PIT
21" BILLET MILL
PUMP HOUSE
DEEP BED BACKWASH
FILTER STORAGE
71.62 l/SEC (1135 GPM)
BLOWDOWN FROM 10" ROD MILL
BLOWDOWN FROM 11" BAR MILL
HOUSE CLEANING SUMP
MILL CLEANING & PICKLING OPERATIONS
pH ADJUSTMENT
RAPID MIX TANK
162 l/SEC (2576 GPM)
CLARIFIER
CLARIFIER
THICKENER
FILTRATE TO RAPID MIX TANK
VACUUM FILTER
SOLIDS
10" ROD MILL
SEAMLESS TUBE FINISHING MILL
11" BAR MILL
SCALE PIT
320.67 l/SEC (5082 GPM)
PUMP STATION
1764 l/SEC (27,969 GPM)
(14) DEEP BED FILTERS
MAIN COLLECTION SUMP
FILTER BACKWASH
53.57 l/SEC (849 GPM)
1711.27 l/SEC (27,120 GPM)
PUMP HOUSE #2
RECYCLE TO MILLS
RIVER WATER MAKE UP
MAKE UP
TO 14" BAR MILL
PUMP HOUSE #1
RIVER MAKE UP
RETENTION BASIN
283 l/SEC (4490 GPM)
37.36 l/SEC (592 GPM)
△ SAMPLING POINT

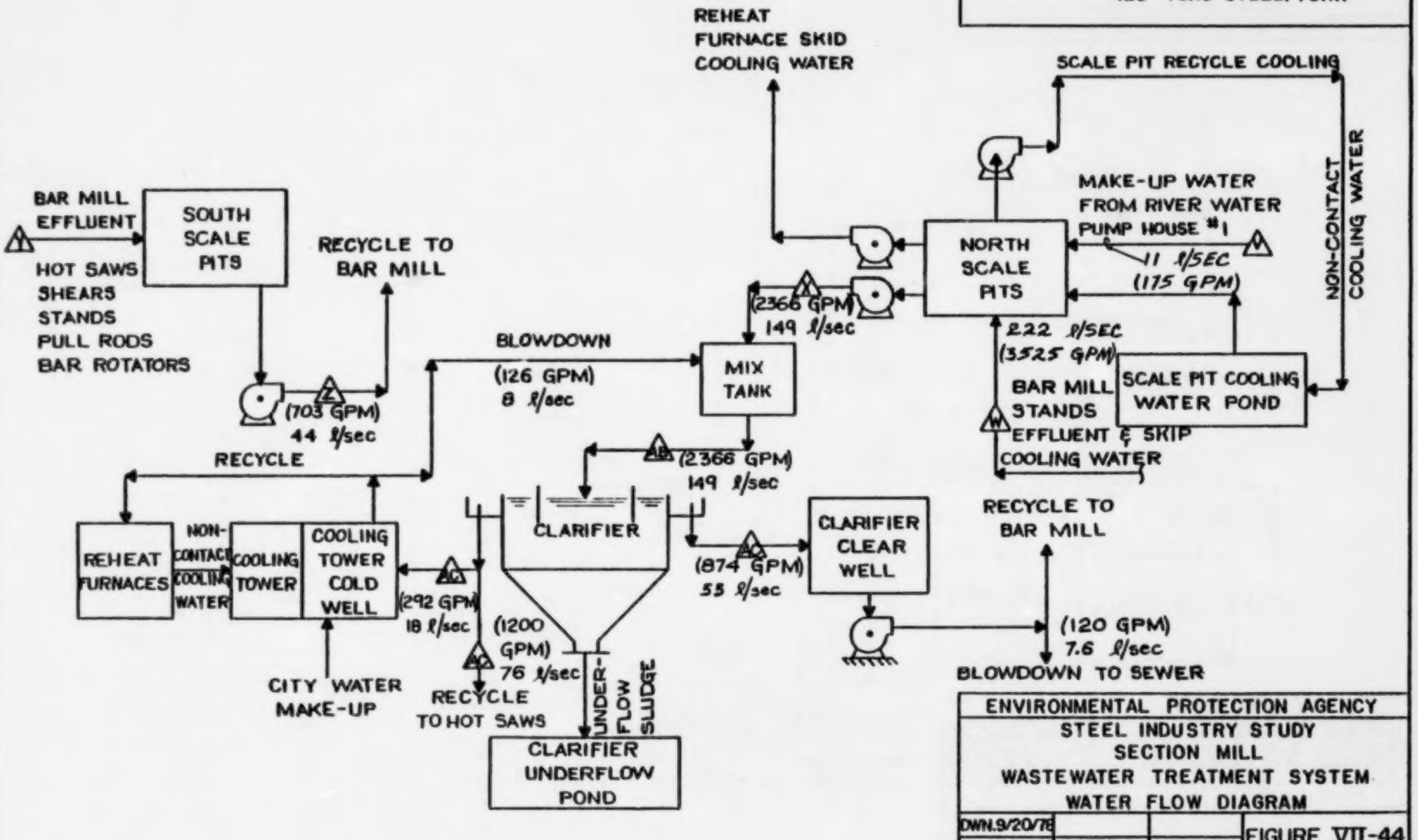
ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
HOT FORMING
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM
DWN. 8/4/78

FIGURE VII-43

PROCESS: SECTION MILL (N)
14" BAR MILL

PLANT: 088

PRODUCTION: 381 METRIC TONS STEEL/TURN
420 TONS STEEL/TURN


BAR MILL EFFLUENT
HOT SAWS
SHEARS
STANDS
PULL RODS
BAR ROTATORS
SOUTH SCALE PITS
RECYCLE TO BAR MILL
(703 GPM)
44 l/sec
RECYCLE
BLOWDOWN
(126 GPM)
8 l/sec
REHEAT FURNACES
NON-CONTACT COOLING WATER
COOLING TOWER
COOLING TOWER COLD WELL
CITY WATER MAKE-UP
(292 GPM)
18 l/sec
(1200 GPM)
76 l/sec
RECYCLE TO HOT SAWS
CLARIFIER
UNDER-FLOW SLUDGE
CLARIFIER UNDERFLOW POND
MIX TANK
(2366 GPM)
149 l/sec
(2366 GPM)
149 l/sec
(874 GPM)
55 l/sec
CLARIFIER CLEAR WELL
RECYCLE TO BAR MILL
(120 GPM)
7.6 l/sec
BLOWDOWN TO SEWER
REHEAT FURNACE SKID COOLING WATER
NORTH SCALE PITS
SCALE PIT RECYCLE COOLING
NON-CONTACT COOLING WATER
MAKE-UP WATER FROM RIVER WATER PUMP HOUSE #1
11 l/SEC
(175 GPM)
222 l/SEC
(3525 GPM)
BAR MILL STANDS EFFLUENT & SKIP COOLING WATER
SCALE PIT COOLING WATER POND

ENVIRONMENTAL PROTECTION AGENCY
STEEL INDUSTRY STUDY
SECTION MILL
WASTEWATER TREATMENT SYSTEM
WATER FLOW DIAGRAM

DWN. 9/20/76

FIGURE VII-44

HOT FORMING SUBCATEGORY

SECTION VIII

COST, ENERGY, AND NONWATER QUALITY IMPACTS

Introduction

This section presents the incremental costs incurred in applying the different levels of pollution control technology to the hot forming subcategory. The analysis addresses energy requirements, nonwater quality impacts, and the techniques, magnitude, and costs associated with the application of the proposed BPT, BAT, BCT, NSPS, PSES, and PSNS limitations and standards. In addition, air pollution, solid waste disposal, the BCT cost comparison, and the consumptive use of water are addressed.

Actual Costs Incurred By the Plants Sampled for this Study

The water pollution control costs supplied by the industry for the hot forming operations sampled during this study and those for operations responding to the D-DCPs are presented in Tables VIII-1 through VIII-5. These costs were adjusted to July 1, 1978 dollars from the actual cost (current year) data supplied by the industry. In most cases the D-DCP cost data are more detailed than the costs supplied for the sampled plants, and are considered to be more representative of treatment costs. Also, where central treatment systems were present, the industry often supplied total costs data for the entire treatment system. The Agency analyzed these costs and apportioned them to determine costs attributable to hot forming wastewaters.

Because of the extensive use of central treatment for hot forming wastewaters, the Agency could not directly verify its model-based cost estimates for each hot forming subdivision with cost data reported by the industry for central treatment systems. However, the Agency did compare its model-based treatment costs with industry costs for several central treatment systems by summing the model-based treatment costs for each subcategory included in the existing central treatment systems. The results of this comparison (presented in Volume I) demonstrate that the Agency's costing methodology accurately reflects industry costs for central treatment facilities in general, and for those systems including hot forming wastewaters in particular. In fact, as shown by the data presented in Volume I, the Agency's cost estimates for separate treatment for all finishing operation wastewaters are likely to be significantly higher than industry costs for central treatment.

Control and Treatment Technology (C&TT) Recommended for Use in the Hot Forming Subcategory

The treatment system components considered for BPT and BAT are presented in Tables VIII-6 and VIII-7. The C&TT steps are identical for primary, section and flat operations and are described in Table

VIII-5. The model BPT treatment system for hot working pipe and tube operations are slightly different than those for the other hot forming operations and are described separately. The proposed limitations do not require the use of the model treatment systems; any treatment system which achieves the proposed limitations is acceptable.

The following items are described in Tables VIII-6 and VIII-7:

1. The individual treatment components
2. Status and reliability
3. Problems and limitations
4. Implementation time
5. Land requirements
6. Environmental impact other than water
7. Solid waste generation and primary constituents

Cost, Energy, and Nonwater Quality Impacts

General Introduction

The installation of the BPT, BCT, BAT, NSPS, PSES, and PSNS alternative treatment systems will involve additional expenditures of money and energy. The Agency estimated costs and energy requirements based upon alternative treatment systems developed in Sections IX through XIII of this report. These data are presented in tables appearing in this section.

Development of Costs for the Hot Forming Subcategory

A treatment model concept and the application of co-mingling factors were used to develop the hot forming cost estimates. These two factors are described below.

Hot Forming Treatment Model Concept

To develop the compliance costs for the alternate treatment systems, actual treatment practices within the hot forming subcategory were analyzed to determine the types of treatment facilities currently in use. First, the Agency found that over 90% of the hot forming operations treat their wastewaters in central treatment systems. Although there are 485 separate hot forming operations in this country, there are about 250 joint treatment facilities. EPA model treatment systems were initially costed on the basis of joint treatment for mills in the same hot forming subdivision. For example, if there are five section mills at one plant site, it was assumed that the combined waste stream from these mills will be treated in one system. Therefore only one treatment system was costed based upon the combined tonnage of the five mills. In this way the affect of joint treatment of like wastewaters (same subdivision) was accounted for in the cost estimates. The Agency believes that this approach is justified since almost all hot forming plants treat the hot forming wastewaters from the same types of mills in a joint treatment system. Likewise, if different hot forming wastewaters are combined in one system (i.e., primary and section wastewaters) still greater cost reductions can be achieved. The cost reductions achieved with this type of treatment system are accounted for by the application of co-mingling factors. These factors are explained below.

Besides identifying plants which jointly treat wastewaters, it was found that the types of treatment systems installed fall into three basic categories. These categories have been developed into treatment model configurations and are shown in Figure VIII-1. Plants that did not fall into one of the three categories were assigned to the third category. As shown, the three models will feed into the BCT/BAT-1 system at different flows and concentrations. However, the BCT/BAT-1 effluents have the same wastewater quality and flow regardless of model type.

Model 1 has treatment components identical to the treatment system proposed in the 1976 regulation for hot forming operations. However, the revised data base has demonstrated different applied flows from the 1976 data base. Out of the 250 joint treatment systems in existence, about 3% were of the Model 1 configuration as of January 1, 1978.

The Model 2 treatment system is the same as Model 1 with the exception that the primary scale pit recycle is not included in Model 2. Approximately 12.5% of the hot forming joint treatment systems were of the Model 2 configuration as of January 1, 1978. Because of the higher flows for Model 2 plants, the cooling tower and recycle components of BCT/BAT-1 are more costly.

For the purpose of costing, all remaining treatment plants have been classified as Model 3 systems. The treatment systems installed at Model 3 plants range from only primary scale pits to extensive central treatment systems. Large and unnecessary capital and annual expenditures would be incurred by the industry if the Model 3 plants were required to install the BPT model treatment system components prior to installing the BCT/BAT treatment technology. It is more efficient to install the BAT treatment system directly without incurring the additional costs for the intermediate BPT model treatment systems. By developing the model concept and recognizing this trend, a more accurate representation of the cost of compliance for the hot forming subcategory has been determined, and a more realistic cost impact on the steel industry can be assessed.

Derivation of Co-Mingling Factors

It has been well documented that central treatment systems are the least costly way to treat wastewaters with similar pollutant characteristics. However, treatment costs have previously been developed strictly from the model plant approach with little consideration of the cost savings achieved with central treatment systems. For hot forming, the Agency completed an inventory which detailed existing joint treatment systems and the types of hot forming wastewaters which are combined. Because all hot forming wastewaters have similar wastewater characteristics and treatability, their combination in joint treatment systems is warranted and practiced throughout the industry.

The Agency calculated the cost reductions achieved with these joint systems on a percentage basis. First, the Agency developed a cost estimate assuming that all plants employed separate treatment. Next, it completed the cost estimate based upon actual treatment practices. For example, if wastewaters from a primary mill and a section mill are combined, the combined treatment system was costed. This type of cost development was done plant by plant and subdivision by subdivision. The costs for the subdivision calculated on the basis of central treatment systems were then divided by the costs for the subdivision developed on the basis of separate treatment to calculate the co-mingling factor for that subdivision. These factors, shown in Tables VIII-9A and 9B, account for the cost reductions achieved with the central treatment systems and were used to more accurately develop the BPT, BAT, and BCT cost estimates presented herein.

Estimated Costs for the Installation of Pollution Control Technologies

A. Costs Required to Achieve the Proposed BPT Limitations

The Agency has estimated that the industry will need to spend about 200 million dollars (capital cost) to bring present water pollution control facilities into compliance with the proposed BPT limitations. The BPT model cost data for the hot forming subcategory are presented in Tables VIII-10 through VIII-19. This 200 million dollars is out of a total estimated capital cost for compliance with the proposed BPT limitations of 650 million dollars. This estimate assumes that 1976 BPT technology will be installed at hot forming operations prior to the BCT/BAT systems, and that the hot forming operations have flow rates as originally developed for the 1976 BPT limitations.

However, the Agency has determined that neither of these assumptions are valid. For example, the new data base has shown that many of the average applied and discharge flow rates are different from those developed from the limited data available in 1975. Additionally, as noted earlier, it is more expensive to install the 1976 BPT model treatment system prior to installing BCT/BAT systems (i.e., installing from Models 1, 2 and 3 to 1976 BPT, then installing BCT/BAT) than to directly install the BCT/BAT treatment systems.

Estimates have been made of the expenditures needed to bring the facilities from current treatment levels to a level from which they can then install the BAT treatment technology; this level is referred to as the "BAT Feed Level". These costs were considered as "BPT Required" costs for purposes of the economic impact analysis of the industry. To develop the costs required to achieve this level, a cost summary based upon a treatment model concept has been established. As explained above, this model concept recognizes the types of treatment systems presently installed and includes the type of components that the plants will install in the future.

Using the rationale explained above, a plant by plant inventory was conducted for each hot forming subdivision to determine the number of plants in each model configuration. Model sizes were then developed for each subdivision based upon average plant sizes of plant sites in each model. Then, using the updated flow rates (see Section X), unit costs for each treatment component were developed. Total cost requirements were then calculated by multiplying the unit costs by the number of components required. The capital and annual cost summaries for the hot forming subcategory are presented in Tables VIII-9A and VIII-9B.

As can be seen in these tables, about $135 million dollars and $13.4 million of additional capital and annual costs, respectively, will be required. These costs are a realistic estimate of hot forming BPT cost requirements taking into account the cost reductions achieved by the use of central treatment systems at hot forming operations.

B. Costs Required to Achieve the Proposed BAT Limitations

The Agency considered two BAT alternative treatment systems for the hot forming operations. BAT Alternative 1 consists of a cooling tower and recycle system for Models 1 and 2 and a cooling tower, recycle system and filter system for Model 3 plants. BAT Alternative 2 includes the components of Alternative 1 and also a sulfide addition system. These alternatives are described in more detail in Section X. The additional capital and operating costs for the hot forming operations are presented in Tables VIII-20 through VIII-45. These costs were developed by subdivision and by model type (1, 2, or 3). Summaries of these costs by subcategory are shown in Tables VIII-46 and VIII-47. Total costs for the two BAT Alternatives are presented below.

	Costs (Millions of Dollars)		
	Capital		Total
	In-place	Required	Annual
BAT-1	100.8	434.7	110.8
BAT-2	100.8	453.5	114.8

C. Costs Required to Achieve the Proposed BCT Limitations

The Agency developed a BCT model treatment system for the hot forming subcategory. The BCT system, component-wise, is identical to the BAT Alternative No. 1. However, the proposed BCT limitations are for only the conventional pollutants. Refer to Section XI for additional information on BCT. Costs for BCT are presented in Table VIII-48 and are fully included in the BAT costs.

D. Costs Required to Achieve NSPS

The Agency considered two NSPS alternative treatment systems for the hot forming operations. New facilities constructed after proposal of these standards will be required to achieve NSPS. The NSPS systems are similar to the BAT alternative treatment systems previously discussed. Model costs have been developed for the two NSPS alternative treatment systems. These costs are shown in Tables VIII-49 through VIII-59 for the hot forming operations.

E. Costs Required to Achieve Pretreatment Standards

Pretreatment standards apply to those plants discharging to POTW systems. The Agency considered one pretreatment model treatment system for all hot forming operations. This system reduces the discharge flow from the plants considerably and reduces the discharge of toxic metal pollutants to low levels. The pretreatment treatment system is identical to the BPT/BAT Model 1 Alternative No. 1 system discussed earlier.

The model cost data for the pretreatment treatment model are the same as the costs for the NSPS No. 1 system. For this reason, additional model costs have not been listed for the pretreatment system. To determine these costs the appropriate NSPS model cost data should be consulted as pointed out in Table VIII-60. Industry-wide PSES costs are included in those for BPT and BAT.

Energy Impacts Due to the Installation of the Requisite Technology

Moderate amounts of energy will be required to operate the various levels of treatment for the hot forming operations. The only significant expenditures will occur at the BAT level due to the energy usage required for recycle systems. The BPT model treatment system components require very little energy partially because of energy credits resulting from reduced intake pumping costs. Energy requirements at NSPS, PSES, and PSNS will be about the same as the total corresponding BAT alternative treatment system.

A. BPT

The Agency estimated the energy expenditures for the BPT treatment systems. These estimates are based upon the assumption that all hot forming operations will install treatment systems as described by the treatment models and at the flow rates determined from the updated data base. It is estimated that the BPT model treatment system components for all hot forming operations in the United States will consume approximately 54.1 million kilowatts of electricity per year. This represents about 0.10% of the 57 billion kilowatts used by the steel industry in 1978.

B. BAT

Additional power consuming equipment will be necessary to upgrade the industry from the BPT treatment system to the two BAT alternative treatment systems. The energy requirements for the two BAT alternatives are presented in Table VIII-61. Assuming all the hot forming operations install Alternative No. 1 technology, the total energy used will be 795.8 million kw, or 1.4% of the electrical energy used by the steel industry in 1978.

If BAT Alternative No. 2 is installed, a small additional amount of energy will be consumed. The total energy requirements for Alternative No. 2 are estimated at 800.1 million kilowatts per year. The Agency considers these energy requirements to be reasonable in light of the substantial environmental benefits achieved, the total energy requirements of the industry, and, energy requirements for zero discharge systems. Moreover, the effluent reduction benefits associated with compliance with this proposed regulation justify these requirements.

C. NSPS, PSES, and PSNS

The NSPS, PSES, and PSNS treatment systems are comprised of the BPT model treatment system and BAT alternative treatment system components. Therefore, the energy requirements per model plant will be equivalent to the summation of the BPT and BAT energy requirements. The Agency did not calculate the energy impacts for NSPS and PSNS since the number of new source hot forming operations was not projected as part of this study. The energy impacts of PSES are included in those listed above for BPT and BAT.

Nonwater Quality Impacts

In general, there are minimal nonwater quality impacts associated with the proposed treatment technologies. The Agency analyzed three impacts: air pollution; solid waste disposal; and water consumption. The Agency found that no significant nonwater quality impacts will result from the installation of the hot forming subcategory treatment systems under consideration.

A. Air Pollution

The use of cooling towers in the BAT Alternative No. 1 system will result in the generation of water vapor plumes; however, these plumes should not contain significant levels of particulates or volatile organics. No other air impacts are expected to occur as a result of the installation of the cooling towers. Therefore, no significant air pollution impacts from this alternative are expected.

BAT Alternative No. 2 (also NSPS Alternative No. 2), contains a sulfide addition system. The use of this component could result in the release of sulfide fumes to the atmosphere in the event of a plant upset when H_2S is used. However, the use of FeS is recommended to avoid this problem. The Agency believes that H_2S emissions would be minimal since hot forming wastes are not acidic. No other air pollution impacts will result from the installation of any of the treatment components considered.

B. Solid Waste Disposal

Sedimentation of the hot forming wastewater, which are high in suspended solids, results in the generation of significant quantities of sludges. The Agency has estimated the amount of solid waste generated in the BPT and BAT treatment systems and has listed these levels in Tables VIII-62 and VIII-63. A summary of these solid wastes generation levels are listed below for BPT and BAT.

Treatment Level	Solid Waste Generation Hot Forming Subcategory (Tons/Year)
BPT	6,014,000
BAT-1	94,829
BAT-2	98,829

As shown above, a significant amount of sludge is generated at the BPT level of treatment. However, most of this solid waste, which consists of both solids and oils, is collected in the primary scale pit. The solids are removed either by clam shell or by drag link conveyor. Oils are usually collected by skimmers or oil troughs. The oils are collected and disposed of off-site if they cannot by reused or reclaimed for other uses. The scale, because of its high iron content, is collected and often reused as feed to sinter plants.

Because most solid and oil collection occurs at the BPT level of treatment, sludge generation at the BAT level of treatment is small, being on the order of 1-2% of the sludge generation at the BPT level. Therefore, there is very little impact with respect to sludge generation as a result of the implementation of either BAT system.

As noted previously, NSPS, PSES, and PSNS systems are made up of BPT and BAT treatment system components. Therefore, the sludge generation at NSPS, PSES, and PSNS will be equivalent to the sludge generation rates of the BPT and BAT systems. However, as explained above, most of the sludge produced at the BPT level of treatment can be reclaimed and reused. This, in combination with the small sludge generation rates in the BAT treatment system components, results in negligible impacts at NSPS, PSES, and PSNS.

C. Water Consumption

In the hot forming subcategory, cooling towers are components of the BAT, BCT, NSPS, PSES, and PSNS alternative treatment systems. Those towers will evaporate some water. Cooling towers are being considered as treatment components in order to allow higher degrees of recycle. The Agency analyzed the degree of water consumption and its impact. However, it found that the degree of water consumption that results from the use of the alternative treatment systems is not severe. The analysis detailed the type of cooling devices in use at hot forming operations, the evaporation rates for the cooling devices in use, and quantified the amount of water that would be consumed in order to meet BAT limitations. It was determined that of the 3900 MGD of process water applied to the hot forming operations, less than 19.4 MGD or 0.5% of this water will be consumed due to evaporation from BAT treatment components. This amount of water consumption is insignificant, even to plants in "arid" or "semi-arid" regions. This analysis is discussed in Section III of Volume I of the Development Document. The Agency finds that the amount of water consumed in complying with this proposed regulation is justified in both a nation-wide and water scarce region basis when compared to the effluent reduction benefits achieved. The high recycle rates also serve to minimize necessary surface and subsurface water withdrawals and run-of-the-river type cooling which can cause nearly as much consumptive loss as evaporative cooling facilities. Plants in arid and semi-arid regions have had high rate recycle systems in operation for many years.

Summary of Impacts

The Agency concludes that the pollution control benefits described below for the hot forming subcategory justify the adverse impacts associated with energy consumption, air pollution, solid waste disposal, or water consumption.

	Effluent Loadings (Tons/Year)		
	Raw Waste	Proposed BPT	Proposed BAT and BCT
Flow, MGD	4,188	2,225	168
TSS	6,017,455	43,860	2,724
Oil and Grease	272,440	24,140	908
Toxic Metals	34,820	1,670*	90

* BAT Feed Value

TABLE VIII-1

EFFLUENT TREATMENT COSTS
HOT FORMING: PRIMARY

(All Costs Are Expressed in July, 1978 Dollars)

Plant Code	A-2	B-2	C-2	D-2	088	-	-
Reference No.	0112B	0112B	0684H	0946A	0684H	0112B	0460A
Mill	-	-	-	-	-	45 x 90 Slabbing	Billet
Initial Investment Cost	$951,800	$1,913,300	$4,083,300	$1,307,900	$2,550,800	$2,577,800	$122,100
Annual Costs							
Cost of Capital	$ 40,000(1)	$ 80,400(1)	$ 172,100(1)	$ 55,000(1)	$ 109,700(1)	$ 195,910(3)	$ 2,430(3)
Depreciation	95,180(2)	191,330(2)	$ 408,340(2)	130,790(2)	255,080(2)	143,210(3)	17,440(3)
Operation and Maintenance	86,600	125,400	142,900	43,200	128,200	2,640	3,590
Energy, Power, Chemicals, etc.	NA	NA	-	-	45,800	65,700	36,900
Credit (Sale of Scale)							34,000
Other						14,550	
TOTAL	$221,180	$ 397,130	$ 723,340	$ 228,990	$ 538,780	$ 442,010	$ 26,360
$/Ton	$0.203	$0.286	$0.483	$0.447	$0.400	$0.251	$0.094

TABLE VIII-1
EFFLUENT TREATMENT COSTS
HOT FORMING: PRIMARY
PAGE 2

Plant Code	-	E	K	081	-
Reference No	0868A	0020B	0256	0176	0440A
Mill	44" Blooming	-	-	-	Slab
Initial Investment Cost	$207,700	$1,307,300	$65,300	$29,800	$2,138,600
Annual Costs					
Cost of Capital	$ 8,930(1)	$ 56,200(1)	$ 2,810(1)	$ 1,280(1)	$ 64,160(3)
Depreciation	20,770(2)	130,730(2)	6,530(2)	2,980(2)	142,570(3)
Operation and Maintenance	27,300	15,900	2,290	12,100	83,600
Energy, Power, Chemicals, etc.		13,100	1,740	1,100	110,000
Credit (Sale of Scale)					
Other					3,600
TOTAL	$ 57,000	$ 202,830	$13,370	$17,470	$ 403,930
$/Ton	$0.151	$0.285	$0.204	$0.22	$9.85

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(1) Cost of capital is based on the formula, Initial Investment x 0.043.
(2) Depreciation is based on the formula, Initial Investment x 0.10.
(3) Company supplied data.

NOTE: For those plants employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-2

EFFLUENT TREATMENT COSTS
HOT FORMING-SECTION

(All costs are expressed in July, 1978 dollars)

Plant Code	A-2	D-2	E-2	F-2	G-2	H-2	I-2	C	H
Reference No.	0112B	0946A	0196A	0384A	0640A	0432A	08560	0424	0248A+B
Mill	-	-	-	-	-	-	-	-	-
Initial Investment Cost($)	2,004,900	1,676,300	2,695,060	4,375,210	1,036,170	471,040	6,935,190	33,790	NA
Annual Costs($)									
Cost of Capital	86,210(1)	72,080(1)	115,890(1)	188,130(1)	44,560(1)	20,250(1)	298,210(1)	1,450(1)	
Depreciation	200,490(2)	167,630(2)	269,510(2)	437,520(2)	103,620(2)	47,100(2)	693,520(2)	3,380(2)	
Operation and Maintenance	181,760	55,290	43,960	163,090	23,130	16,640	108,870	490	
Energy, Power, Chemicals, etc.	NA	83,200	60,630	112,980		6,990	840	1,340	
Other			250	5,570			65,750		
TOTAL($)	468,460	378,200	490,140	907,290	171,310	90,980	1,167,190	6,660	
$/ton	0.308	0.674	0.977	2.56	1.109	0.244	2.75	0.630	

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(1) Cost of capital is based on the formula: Initial Investment x 0.043.
(2) Depreciation is based on the formula: Initial Investment x 0.10.
(3) Company Basis Data.
(4) Costs of central treatment cannot be apportioned; therefore, these are total system costs.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-2
EFFLUENT TREATMENT COSTS
HOT FORMING-SECTION
PAGE 2

Plant Code	K	O	R	M	Q	081	083	087	088
Reference No.	0256	0176	0240A	0432J	0684D	0176(01-03)	0860H	0432A-02	0684H(06-07)
Mill	-	-	-	-	-	Nos. 1+2		14" Merchant	10"/11"
Initial Investment Cost($)	292,570	383,900	NA	NA	226,580	28,500	Cost Data Was Not Supplied	3,042,700	469,800
Annual Costs($)									
Cost of Capital	12,580(1)	16,510(1)			9,740(1)	1,200(1)		130,800(1)	20,200(1)
Depreciation	29,260(2)	38,390(2)			22,660(2)	2,850(2)		304,270(2)	47,000(2)
Operation and Maintenance	10,240	13,440			12,790	11,600		67,200	23,600
Energy, Power	110	140			-	1,100		12,400	8,400
Chemicals, etc.									
Other									
TOTAL($)	52,190	68,480			45,190	16,750		514,670	99,200
$/ton	2.86	1.15			0.078	0.278		0.887	0.126

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(1) Cost of capital is based on the formula: Initial Investment x 0.043.
(2) Depreciation is based on the formula: Initial Investment x 0.10.
(3) Company Basis Data.
(4) Costs of central treatment cannot be apportioned; therefore, these are total system costs.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-2
EFFLUENT TREATMENT COSTS
HOT FORMING-SECTION
PAGE 3

Plant Code	088	088	081	088	-	-	-	-
Reference No.	0684H-03	0684H-01	0176-04	0684H-02	0060F-05(5)	0068B(4)	0088D(5)	0136B
Mill	32"	36"	No. 4 Spec.	34" Spec.	Wide Flange	12" Bar	Bar Mill	10" Bar
Initial Investment Cost($)	100,900	469,800	1,880	79,100	2,736,900	237,770	491,400	Costs Are Not Applicable
Annual Costs($)								
Cost of Capital	4,300(1)	20,200(1)	80(1)	3,400(1)	117,700(1)	35,670(3)	21,130(1)	Discharge
Depreciation	10,100(2)	47,000(2)	190(2)	7,910(2)	273,700(2)	13,210(3)	49,140(2)	to
Operation and Maintenance	5,100	23,600	760	4,000	146,230	50,880	29,090	POTW
Energy, Power Chemicals, etc.	1,800	8,400	70	1,400	49,120	-	8,760	
Other					40,140	3,230	800	
TOTAL($)	21,300	99,200	1,100	16,710	626,890	102,990	108,920	
$/ton	0.0341	0.174	0.014	0.020	3.19(6)	1.080	0.42(6)	

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(1) Cost of capital is based on the formula: Initial Investment x 0.043.
(2) Depreciation is based on the formula: Initial Investment x 0.10.
(3) Company Basis Data.
(4) Costs of central treatment cannot be apportioned; therefore, these are total system costs.
(5) Cost apportionment is based on company estimate of percentage.
(6) Total Annual Cost ÷ Total 1977 Production.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-2
EFFLUENT TREATMENT COSTS
HOT FORMING-SECTION
PAGE 4

Plant Code	-	-	-	-	-
Reference No.	0136B	0612(01-04)(5)	0672B	0684H-05	0860H-03
Mill	14" Bar	24" Wide Flange	I-Beam, Rail	14" Bar	Rod
Initial Investment Cost($)	Operation Discontinued 11/77	5,760,000	No Cost Data Available	5,014,790	3,331,650
Annual Costs($)					
Cost of Capital		247,680(1)		215,540(1)	143,260(1)
Depreciation		576,000(2)		501,480(2)	333,170(2)
Operation and Maintenance		181,760		106,750	167,000
Energy, Power, Chemicals, etc.		266,240		81,800	-
Other				28,950	-
TOTAL($)		1,271,680		934,520	643,430
$/ton		1.01		1.99	1.82

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(1) Cost of capital is based on the formula: Initial Investment x 0.043.
(2) Depreciation is based on the formula: Initial Investment x 0.10.
(3) Company Basis Data.
(4) Costs of central treatment cannot be apportioned; therefore, these are total system costs.
(5) Cost apportionment is based on company estimate of percentage.
(6) Total Annual Cost ÷ Total 1977 Production.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-3

EFFLUENT TREATMENT COSTS
HOT FORMING-FLAT
HOT STRIP AND SHEET

(All costs are expressed in July, 1978 dollars)

Plant Code	E	M-2	N-2	086	087	-	-	-	-
Reference No.	0020B	0384A	0060R	0112D	0432A	0060	0432C	0684V	0920W
Mill($)	-	-	-	80"	44"	80"	80"	South Jobbing	80"
Initial Investment Cost	1,901,300	10,604,000	2,007,800	30,734,300	8,153,600	23,133,760	7,050,800	459,530	4,381,000
Annual Costs($)									
Cost of Capital	81,800$^{(1)}$	441,200$^{(1)}$	84,300$^{(1)}$	1,322,000$^{(1)}$	350,600$^{(1)}$	1,943,240$^{(3)}$	303,180$^{(1)}$	19,760$^{(1)}$	188,380$^{(1)}$
Depreciation	190,130$^{(2)}$	1,050,400$^{(2)}$	200,780$^{(2)}$	3,074,530$^{(2)}$	815,360$^{(2)}$	1,156,690$^{(3)}$	705,080$^{(2)}$	45,950$^{(2)}$	438,100$^{(2)}$
Operation and Maintenance	66,500	344,400	252,900	809,700	166,000	787,350	246,780$^{(4)}$	16,080$^{(4)}$	153,340$^{(4)}$
Energy, Power, Chemicals, etc.	27,900	196,400		316,800	30,700	606,940			
Other						25,360			
TOTAL($)	366,330	2,062,400	537,980	5,523,030	1,362,660	4,519,580	1,255,040	81,790	779,820
$/Ton	0.492	0.606	0.928	1.496	0.705	1.935	0.469	10.622	0.321

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(1) Cost of capital is based on the formula, Initial Investment x 0.043.
(2) Depreciation is based on the formula, Initial Investment x 0.10.
(3) Company Basis Data.
(4) Costs are based on the formula, Initial Investment x 0.035.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-4

EFFLUENT TREATMENT COSTS
HOT FORMING-FLAT
PLATE

(All cost are expressed in July, 1978 dollars)

Plant Code :	J-2	K-2	086	-	-
Reference No.:	0860B	0860B	0112D	0684B	0684F
Mill :	-	-	160"	56"	84"
Initial Investment Cost	14,478,500	4,482,900	7,560,300	2,219,100	32,799,500
Annual Costs					
Cost of Capital	621,100(1)	188,300(1)	325,100(1)	95,420(1)	1,311,980(3)
Depreciation	1,447,850(2)	488,290(2)	756,030(2)	221,910(2)	1,639,980(3)
Operation and Maintenance	269,100	555,400	415,900	UNK	587,950
Energy, Power, Chemicals, etc.	105,200		162,700	114,700	542,360
Other	98,500		24,100	45,180	60,660
TOTAL($)	2,541,750	1,231,990	1,683,830	447,210	3,872,930
$/Ton	0.812	1.19	1.213	0.313	2.055

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(1) Cost of capital is based on the formula, Initial Investment x 0.043.
(2) Depreciation is based on the formula, Initial Investment x 0.10.
(3) Company Basis Data.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the basis of flow.

TABLE VIII-5

EFFLUENT TREATMENT COSTS
HOT WORKED PIPE AND TUBE

(All costs are expressed in July, 1978 dollars)

Plant Code :	0196A	0916A	0728	0256G	0432A	0684H	-	-	-
Reference No.:	E-2	II-2	JJ-2	KK-2	087	088	0240B	0652A	0728
Mill :	-	-	-	-	-	-	Hot Mill	Tube	CW
Initial Investment Cost($)	879,400	393,300	57,900	9,800	1,285,600	1,201,400	824,400	285,300	192,500
Annual Costs($)									
Cost of Capital	36,900(1)	16,500(1)	2,400(1)	415(1)	55,280(1)	51,700(1)	82,440(3)	12,270(1)	8,280(1)
Depreciation	87,940(2)	39,330(2)	5,790(2)	980(2)	128,560(2)	120,100(2)	41,220(3)	28,530(2)	19,250(2)
Operation and Maintenance	14,300	2,760	9,200	9,400	28,400	36,900	14,350	10,000	30,780
Energy, Power, Chemicals, etc.	19,800	5,900	10,400	1,000	5,250	21,500	1,970	-	NA
Other							12,990	1,000	
TOTAL($)	158,940	64,490	27,790	11,795	217,490	230,200	152,970	51,800	58,310
$/Ton	0.930	0.379	0.398	0.093	1.087	0.166	*	1.079	1.500

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(1) Cost of Capital is based on the formula, Initial Investment x 0.043.
(2) Depreciation is based on the formula, Initial Investment x 0.10.
(3) Company Basis Data.

* : Confidential Information.

NOTE: For those operations employing central treatment facilities, costs are apportioned on the bases of flow.

TABLE VIII-6

CONTROL AND TREATMENT TECHNOLOGIES
HOT FORMING - PRIMARY, SECTION, AND FLAT

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Primary Scale Pit - This step provides the initial stage for removal of heavy mill scale and the heavier suspended solids.	Widely used in the hot forming subcategory as an integral part of their operations.	Accumulated scale must be removed by clam shell or other devices on a regular basis.	6-9 months	Refer to Table VIII-8	Although mill scale removed from the scale pit is usually returned to other steel plant operations, any remaining scale and solids must receive proper disposal.	The solid waste generation rates are presented in Table VIII-62. The scale consists basically of metallic oxides removed from the surface of the hot formed product.
B. Surface Skimming - Removes oils and greases from the surface of the wastewater.	Very widely used in the hot forming subcategory as well as in other steel plant wastewater treatment operations.	Hydraulic overload or surface turbulence will result in poor oil removal performance.	3 months	Refer to Table VIII-8	The skimmed oils and greases must receive proper disposal.	Refer to Table VIII-62 for the skimmed oil generation rates associated with the various hot forming operations.
C. Recycle - Recycles a portion of the primary scale pit effluent back to the hot forming operation (principally for flume flushing).	This type of recycle operation is widely used throughout the hot forming subcategory.	The potential exists for scaling and plugging due to the increased dissolved solids concentrations associated with recycle operations.	12-15 months	Refer to Table VIII-8	None	None

TABLE VIII-6
CONTROL AND TREATMENT TECHNOLOGIES
HOT FORMING - PRIMARY, SECTION, AND FLAT
PAGE 2

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
D. Roughing Clarifier - Provides the capability for additional suspended solids removal.	Widely used in the hot forming subcategory and throughout the steel industry in various wastewater treatment operations.	Hydraulic surges must be controlled. In addition, routine or continuous solids removal must be provided in order to prevent excessive solids accumulation which in turn could damage the clarifier rake drive mechanism.	15-18 months	Refer to Table VIII-8	The sludges removed from the clarifier and delivered to the vacuum filter must ultimately receive proper disposal.	Refer to Table VIII-62 for the generation rates of solids, consisting primarily of metal oxides, for each hot forming operation.
E. Vacuum Filter - Used to dewater the sludges removed in Step D.	Very widely used both in the hot forming subcategory and in many other steel industry wastewater treatment operations.	Routine maintenance of vacuum pumps and filter mechanism is necessary. Filter media must be replaced periodically.	15-18 months	Refer to Table VIII-8	The dewatered solids (filter cake) must receive proper disposal.	The quantities of filter cake generated at this step are included in Table VIII-62. The solids in the filter cake are similar in nature to those removed at the scale pit and are the same as those removed from the roughing clarifier.

TABLE VIII-6
CONTROL AND TREATMENT TECHNOLOGIES
HOT FORMING - PRIMARY, SECTION, AND FLAT
PAGE 3

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
F. Deep Bed Pressure Filter - These filters provide additional suspended solids removal capability. The backwash is returned to the roughing clarifier.	Used at a number of hot forming operations as well as in a wide variety of other steel industry wastewater treatment applications.	Hydraulic overloads must be controlled. Poor solids removal in Step D will impede efficient filter operation.	15-18 months	Refer to Table VIII-8	The backwash solids must receive proper disposal.	The backwash solids are eventually removed from the treatment system by the vacuum filter (Step E). Refer to Table VIII-62 for the quantities of solids removed. The backwash solids are similar in nature to the other solids removed by this treatment system.
G. Cooling Tower - Used to reduce the heat load of the wastewater recycle system.	Widely used in the hot forming subcategory as well as in numerous other steel industry water/wastewater recycle processes.	The potential exists for scaling and plugging due to the increased dissolved solids concentrations associated with cooling and recycle operations. In addition, biological fouling within the cooling tower must be controlled.	18-20 months	Refer to Table VIII-8	Any sludge which may accumulate in the cooling tower will require proper disposal. Care must be exercised in the selection and use of chemicals used to controi fouling.	Virtually nil.

TABLE VIII-6
CONTROL AND TREATMENT TECHNOLOGIES
HOT FORMING - PRIMARY, SECTION, AND FLAT
PAGE 4

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
H. Recycle - Increase the recycle rate to reduce the discharge flows to the BAT/BCT levels.	This type of recycle operation is widely used throughout the hot forming subcategory.	The potential exists for scaling and plugging due to the increased dissolved solids concentrations associated with recycle operations.	12-15 months	Refer to Table VIII-8	None	None
I. Filtration - These filters provide additional suspended solids removal capability. The backwash is returned to the roughing clarifier.	Used at a number of hot forming operations as well as in a wide variety of other steel industry wastewater treatment applications.	Hydraulic overloads must be controlled. Poor solids removal in Step D will impede efficient filter operation.	15-18 months	Refer to Table VIII-8	The backwash solids must receive proper disposal.	The backwash solids are eventually removed from the treatment system by the vacuum filter (Step E). Refer to Table VIII-62 for the quantities of solids removed. The backwash solids are similar in nature to the other solids removed by this treatment system.

TABLE VIII-6
CONTROL AND TREATMENT TECHNOLOGIES
HOT FORMING - PRIMARY, SECTION, AND FLAT
PAGE 5

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
J. Sulfide Precipitation - Addition of iron sulfide to form metallic sulfide precipitates which are subsequently removed via filtration.	Used in various industrial wastewater treatment operations for the purpose of toxic metals removal.	Care must be exercised in the handling of the feed solution. Careful treatment process control is required to prevent odor problems.	6 months	Refer to Table VIII-8	The resultant metallic sulfide precipitates require proper disposal. Sulfide odors can result if the treatment process is not adequately controlled.	The metallic sulfide precipitates generated in this step are removed by the deep bed pressure filter and subsequently through the vacuum filter. The amounts of solids generated in this step are minimal and have already been included in the filtration steps (refer to Table VIII-63).
K. Filtration -These filters provide additional suspended solids removal capability. The backwash is returned to the roughing clarifier.	Used at a number of hot forming operations as well as in a wide variety of other steel industry wastewater treatment applications.	Hydraulic overloads must be controlled. Poor solids removal in Step D will impede efficient filter operation.	15-18 months	Refer to Table VIII-8	The backwash solids must receive proper disposal.	The backwash solids are eventually removed from the treatment system by the vacuum filter (Step E). Refer to Table VIII-63 for the quantities of solids removed. The backwash solids are similar in nature to the other solids removed by this treatment system.

TABLE VIII-7

CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
A. Primary Scale Pit - This step provides the initial stage for removal of heavy mill scale and the heavier suspended solids.	Widely used in the hot forming subcategory as an integral part of their operations.	Accumulated scale must be removed by clam shell or other devices on a regular basis.	6-9 months	Refer to Table VIII-8	Although mill scale removed from the scale pit is usually returned to other steel plant operations, any remaining scale and solids must receive proper disposal.	The solid waste generation rates are presented in Table VIII-62. The scale consists basically of metallic oxides removed from the surface of the hot formed product.
B. Surface Skimming - Removes oils and greases from the surface of the wastewater.	Very widely used in the hot forming subcategory as well as in other steel plant wastewater treatment operations.	Hydraulic overload or surface turbulence will result in poor oil removal rates.	3 months	Refer to Table VIII-8	The skimmed oils and greases must receive proper disposal.	Refer to Table VIII-62 for the skimmed oil generation rates associated with the hot working pipe and tube operations.
C. Roughing Clarifier - Provides the capability for additional suspended solids removal.	Widely used in the hot forming subcategory and throughout the steel industry in various wastewater treatment operations.	Hydraulic surges must be controlled. In addition, routine or continuous solids removal must be provided in order to prevent excessive solids accumulation which in turn could damage the clarifier rake drive mechanism.	15-18 months	Refer to Table VIII-8	The sludge removed from the clarifier and delivered to the vacuum filter must ultimately receive proper disposal.	Refer to Table VIII-62 for the generation rates of solids, consisting primarily of metal oxides, for each hot forming operation.

TABLE VIII-7
CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE
PAGE 2

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
D. Vacuum Filter - Used to dewater the sludges removed in Step C.	Very widely used both in the hot forming subcategory and in many other steel industry wastewater treatment operations.	Routine maintenance of vacuum pumps and filter mechanism is necessary. Filter media must be replaced periodically.	15-18 months	Refer to Table VIII-8	The dewatered solids (filter cake) must receive proper disposal.	The quantities of filter cake generated at this step are presented in Table VIII-62. The solids in the filter cake are similar in nature to those removed at the scale pit and are the same as those removed from the roughing clarifier.
E. Recycle - Recycles a portion of the roughing clarifier effluent back to the pipe and tube operation.	This type of recycle operation is widely used throughout the hot forming subcategory.	The potential exists for scaling and plugging due to the increased dissolved solids concentrations associated with recycle operations, however, numerous pipe and tube operations have operated these recycle systems without any problems.	12-15 months	Refer to Table VIII-8	None	None

TABLE VIII-7
CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE
PAGE 3

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
F. Deep Bed Pressure Filter - These filters provide additional suspended solids removal capability. The backwash is returned to the roughing clarifier.	Used at a number of hot forming operations as well as in a wide variety of other steel industry wastewater treatment applications.	Hydraulic overloads must be controlled. Poor solids removal in Step C will impede efficient filter operation.	15-18 months	Refer to Table VIII-8	The backwash solids must receive proper disposal.	The backwash solids are eventually removed from the treatment system by the vacuum filter (Step D). Refer to Table VIII-62 for the quantities of solids removed. The backwash solids are similar in nature to the other solids removed by this treatment system.

The following step is presented in association with the isolated treatment system model developed for BPT in the original study. All of the previous steps (A through F) are incorporated in the integrated BPT treatment system model developed during the original study. Steps A, B, and E are used in conjunction with this step for the isolated treatment model.

TABLE VIII-7
CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE
PAGE 4

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
G. Settling Lagoon - This component provides suspended solids removal capability in addition to that provided in the scale pit.	Widely used in the hot forming subcatgory as well as in a variety of other steel industry wastewater treatment and/or recycle operations.	Land requirements are greater than those of other treatment components (roughing clarifiers, etc.) capable of similar performance.	9-12 months	Refer to Table VIII-8	Land usage	The solids, which consist primarily of metal oxides, are removed periodically by clam shell. The solid waste generation rates for this step are presented in Table VIII-62.
H. Cooling Tower - Used to reduce the heat load of wastewater recycle system.	Widely used in the hot forming subcategory as well as in numerous other steel industry water/wastewater recycle processes.	The potential exists for scaling and plugging due to the increased dissolved solids concentrations associated with cooling and recycle operations. In addition, biological fouling within the cooling tower must be controlled.	18-20 months	Refer to Table VIII-8	Any sludge which may accumulate in the cooling tower will require proper disposal. Care must be exercised in the selection and use of chemicals used to control fouling.	Virtually nil.

TABLE VIII-7
CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE
PAGE 5

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
I. Recycle - Increase the recycle rate to reduce the discharge flows to the BAT/BCT levels.	This type of recycle operation is widely used throughout the hot forming subcategories.	While the potential exists for scaling and plugging due to the increased dissolved solids concentrations associated with recycle operations, none were reported by the pipe and tube operations utilizing high recycle systems.	12-15 months	Refer to Table VIII-8	None	None
J. Filtration - These filters provide additional suspended solids removal capability. The backwash is returned to the roughing clarifier.	Used at a number of hot forming operations as well as in a wide variety of other steel industry wastewater treatment applications.	Hydraulic overloads must be controlled. Poor solids removal in Step C will impede efficient filter operation.	15-18 months	Refer to Table VIII-8	The backwash solids must receive proper disposal.	The backwash solids are eventually removed from the treatment system by the vacuum filter (Step D). Refer to Table VIII-62 for the quantities of solids removed. The backwash solids are similar in nature to the other solids removed by this treatment system.

TABLE VIII-7
CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE
PAGE 6

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
K. Sulfide Precipitation - Addition of iron sulfide to form metallic sulfide precipitates which are subsequently removed via filtration.	Used in various industrial wastewater treatment operations for the purpose of toxic metals removal.	Care must be exercised in the handling of the feed solution. Careful treatment process control is required to prevent odor problems.	6 months	Refer to Table VIII-8	The resultant metallic sulfide precipitates require proper disposal. Sulfide odors can result if the treatment process is not adequately controlled.	The metallic precipitates generated in this step are removed by the deep bed pressure filter and subsequently through the vacuum filter. The amounts of solids generated in this step are minimal and have already been included in both filtration steps (refer to Table VIII-63).

TABLE VIII-7
CONTROL AND TREATMENT TECHNOLOGIES
HOT WORKING PIPE AND TUBE
PAGE 7

Treatment and/or Control Methods Employed*	Status and Reliability	Problems and Limitations	Implementation Time	Land Requirements	Environmental Impact Other Than Water	Solid Waste Generation and Primary Constituents
L. Filtration - These filters provide additional suspended solids removal capability. The backwash is returned to the roughing clarifier.	Used at a number of hot forming operations as well as in a wide variety of other steel industry wastewater treatment applications.	Hydraulic overloads must be controlled. Poor solids removal in Step C will impede efficient filter operation.	15-18 months	Refer to Table VIII-8	The backwash solids must receive proper disposal.	The backwash solids are eventually removed from the treatment system by the vacuum filter (Step D). Refer to Table VIII-63 for the quantities of solids removed. The backwash solids are similar in nature to the other solids removed by this treatment system.

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*: Listed in order of increasing effectiveness.

TABLE VIII-8A

LAND REQUIREMENTS SUMMARY
HOT FORMING SUBCATEGORY

BPT Treatment Models

	C&TT Steps					
Subdivision	A (PSP)	B (SS)	C (RUP)	D (CL)	E (VF)	F (Filter)
PRIMARY						
a. Carbon						
w/o scarfers	30' x 50'	(1)	20' x 30'	40' x 40'	20' x 20'	50' x 50'
w/scarfers	30' x 40'	(1)	20' x 30'	35' x 35'	15' x 15'	45' x 45'
b. Specialty	25' x 40'	(1)	25' x 25'	30' x 30'	15' x 15'	30' x 30'
SECTION						
a. Carbon	40' x 65'	(1)	20' x 30'	45' x 45'	20' x 20'	65' x 65'
b. Specialty	30' x 50'	(1)	20' x 30'	35' x 35'	15' x 15'	45' x 45'
FLAT						
a. Hot Strip and Sheet	60' x 110'	(1)	15' x 50'	80' x 80'	30' x 30'	100' x 100'
b. Carbon Plate	40' x 70'	(1)	20' x 30'	60' x 60'	20' x 20'	85' x 85'
c. Specialty Plate	35' x 65'	(1)	25' x 25'	55' x 55'	20' x 20'	75' x 75'

---

(1) No additional land required

NOTE: For definitions of C&TT codes refer to Table VII-1.

TABLE VIII-8B

LAND REQUIREMENTS SUMMARY
HOT FORMING SUBCATEGORY

BPT Treatment Models

	C&TT Steps						
Subdivision	A (PSP)	B (SS)	C (CL)	D (VF)	E (RTP)	F (Filter)	G (SL-1)
PIPE AND TUBE							
a. Integrated	25' x 35'	(1)	35' x 35'	15' x 15'	15' x 35'	25' x 25'	(2)
b. Isolated	25' x 35'	(1)	(2)	(2)	25' x 25'	(2)	200' x 400'

---

(1) No additional land required
(2) This component is not included in this particular model.

NOTE: For definitions of C&TT codes refer to Table VII-1.

TABLE VIII-8C

LAND REQUIREMENTS SUMMARY
HOT FORMING SUBCATEGORY

BAT and BCT Treatment Models

	C&TT Steps				
	BAT Alternative No. 1/BCT			BAT Alternative No. 2(1)	
	G (CT)	H (RTP)	I (Filter)	J (PS)	K (Filter)
PRIMARY					
a. Carbon w/o scarfing					
Model No. 2	45' x 45'	35' x 35'	(2)	(3)	30' x 35'
Model No. 3	40' x 40'	30' x 30'	30' x 40'	14' x 14'	(2)
b. Carbon w/scarfing					
Model No. 1	30' x 30'	25' x 25'	(2)	(3)	30' x 35'
Model No. 2	55' x 55'	35' x 35'	(2)	(3)	31' x 45'
Model No. 3	40' x 40'	35' x 35'	45' x 45'	15' x 15'	(2)
c. Specialty w/o scarfing					
Model No. 2	40' x 40'	32' x 32'	(2)	(3)	20' x 35'
Model No. 3	20' x 20'	20' x 20'	15' x 20'	10' x 10'	(2)
d. Specialty w/scarfing					
Model No. 3	25' x 25'	25' x 25'	20' x 20'	10' x 10'	(2)
SECTION					
a. Carbon					
Model No. 1	25' x 25'	25' x 25'	(2)	(3)	20' x 25'
Model No. 2	60' x 60'	40' x 40'	(2)	(3)	30' x 55'
Model No. 3	40' x 40'	30' x 30'	30' x 40'	14' x 14'	(2)
b. Specialty					
Model No. 1	25' x 25'	25' x 25'	(2)	(3)	20' x 25'
Model No. 2	35' x 35'	30' x 30'	(2)	(3)	30' x 30'
Model No. 3	25' x 25'	25' x 25'	20' x 20'	10' x 10'	(2)
FLAT					
a. Hot Strip and Sheet					
Model No. 1	65' x 195'	40' x 60'	(2)	(3)	50' x 100'
Model No. 2	65' x 125'	40' x 60'	(2)	(3)	50' x 65'
Model No. 3	55' x 105'	40' x 50'	50' x 60'	17' x 17'	(2)
b. Carbon Plate					
Model No. 2	50' x 100'	40' x 40'	(2)	(3)	45' x 50'
Model No. 3	40' x 40'	30' x 30'	30' x 30'	10' x 15'	(2)
c. Specialty Plate					
Model No. 2	35' x 35'	30' x 30'	(2)	(3)	30' x 30'
Model No. 3	10' x 10'	15' x 15'	10' x 15'	8' x 8'	(2)

---

(1) These land requirements are in addition to those of Alternative No. 1. Each Model's Alternative No. 2 incorporates all of the components of Alternative No. 1.

(2) Not required.

(3) Included in Step F's requirements.

TABLE VIII-8D

LAND REQUIREMENTS SUMMARY
HOT FORMING SUBCATEGORY

BAT and BCT Treatment Models

	C&TT Steps				
	BAT Alternative No. 1/BCT			BAT Alternative No. 2[1]	
	H (CT)	I (RTP)	J (Filter)	K (PS)	L (Filter)
PIPE AND TUBE					
a. Carbon					
Model No. 1	25' x 25'	25' x 25'	(2)	(3)	20' x 25'
Model No. 2	25' x 25'	25' x 25'	(2)	(3)	20' x 20'
Model No. 3	25' x 25'	25' x 25'	20' x 25'	10' x 15'	(2)
b. Specialty					
Model No. 2	40' x 40'	30' x 30'	(2)	(3)	20' x 35'
Model No. 3	15' x 15'	20' x 20'	15' x 20'	8' x 10'	(2)

---

(1) These land requirements are in addition to those of Alternative No. 1. Each Model's Alternative No. 2 incorporates all of the components of Alternative No. 1.
(2) Not Required.
(3) Included in Step F's requirements.

TABLE VIII-9A

BAT FEED CAPITAL COST REQUIREMENTS
HOT FORMING

	CONTROL AND TREATMENT TECHNOLOGY STEPS												
	A		B		C		D		E				
Subcategory	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	Total Capital Cost ($\$x10^{-6}$)	Co-Mingling Factor (1)	Adjusted Capital Cost (2) ($\$x10^{-6}$)
PRIMARY													
a. Carbon													
w/o scarfers	4	1.34	3	0.11	17	14.25	5	2.46	24	6.48	24.60	.62	15.25
w/scarfers	1	0.40	6	0.30	15	15.15	6	0.20	24	8.61	24.66		15.29
b. Specialty													
w/o scarfers	1	0.14	3	0.062	5	1.94	1	0.32	9	1.32	3.78	.76	2.87
w/scarfers	1	0.17	0	0	2	0.96	0	0	1	0.13	1.26		0.96
SECTION													
a. Carbon	0	0	11	0.46	23	17.85	9	7.13	43	9.25	34.69	.83	28.79
b. Specialty	0	0	6	0.14	5	2.39	4	1.87	10	0.86	5.26	.83	4.36
FLAT													
a. Hot Strip & Sheet	2	1.20	8	0.73	16	25.06	6	20.84	34	12.54	60.37	.88	53.13
b. Plate (Carbon)	0	0	1	0.025	5	3.57	1	0.75	11	2.65	7.00	.70	4.90
c. Plate(Specialty)	0	0	1	0.013	3	0.46	2	0.18	5	0.59	1.24	.96	1.19
PIPE & TUBE													
a. Carbon	4	0.83	9	0.21	10	4.81	6	4.15	20	3.69	13.69	.55	7.53
b. Specialty	0	0	0	0	2	0.61	1	0.36	6	0.62	1.59	.62	0.99
									TOTALS:		178.14		135.26

---

(1) Calculated factors which account for cost reductions achieved by the use of central treatment systems.

(2) These capital costs have been adjusted by applying co-mingling factors which reduce overall costs by taking into account cost reductions achieved by the use of central treatment systems in the hot forming operations.

KEY TO C&TT STEPS

A: Primary Scale Pit (PSP)	D: Clarifier or Settling Cone
B: Surface Skimming	E: Vacuum Filter
C: Recycle from PSP	

TABLE VIII-9B

BAT FEED ANNUAL COST REQUIREMENTS
HOT FORMING

	CONTROL AND TREATMENT TECHNOLOGY STEPS												
	A		B		C		D		E				
Subcategory	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	No. Req.	Total Cost ($\$x10^{-6}$)	Total Annual Cost ($\$x10^{-6}$)	Co-Mingling Factor(1)	Adjusted Annual Cost(2) ($\$x10^{-6}$)
PRIMARY													
a. Carbon													
w/o scarfers	4	-6.4	3	0.002	17	2.5	5	0.4	24	1.0	-2.5	.62	-1.6
w/scarfers	1	-2.9	6	-0.004	15	2.7	6	1.1	24	1.1	2.0		1.2
b. Specialty													
w/o scarfers	1	-0.2	3	0.009	5	0.5	1	0.06	9	0.2	0.6	.76	0.5
w/scarfers	1	-0.5	0	0	2	0.2	0	0	1	0.02	-0.3		-0.2
SECTION													
a. Carbon	0	0	11	-0.02	23	3.2	9	1.3	43	1.5	6.0	.83	5.0
b. Specialty	0	0	6	0.01	5	0.4	4	0.3	10	0.2	0.9	.83	0.7
FLAT													
a. Hot Strip & Sheet	2	-0.9	8	0.06	16	4.4	6	3.7	34	0.1	7.4	.88	6.5
b. Plate (Carbon)	0	0	1	-0.2	5	0.6	1	0.1	11	0.3	0.8	.70	0.6
c. Plate (Specialty)	0	0	1	0.002	3	0.08	2	0.03	5	0.1	0.2	.96	0.2
PIPE AND TUBE													
a. Carbon	4	-1.5	9	0.02	10	0.9	6	0.7	20	0.6	0.7	.55	0.4
b. Specialty	0	0	0	0	2	0.1	1	0.06	6	0.06	0.2	.62	0.1
									TOTALS:		16.0		13.4

---

(1) Calculated factors which account for cost reductions achieved by the use of central treatment systems.

(2) These annual costs have been adjusted by applying co-mingling factors which reduce overall costs by taking into account cost reductions achieved by the use of central treatment systems in the hot forming operations.

KEY TO C&TT STEPS

A: Primary Scale Pit (PSP)
B: Surface Skimming
C: Recycle from PSP
D: Clarifier or Settling Cone
E: Vacuum Filter

TABLE VIII-10

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Primary
: Carbon
: Without Scarfers

Model Size-TPD : 6400
Oper. Days/Year: 260
Turns/Days : 3

C&TT Steps	A	B	C	D	E	F	Total
Investment $ X 10^{-3}	219.6	31.5	556.0	568.5	193.2	1436	3004.8
Annual Cost $ X 10^{-3}							
Capital	9.4	1.4	23.9	24.5	8.3	61.8	129.3
Depreciation	22.0	3.1	55.6	56.9	19.3	143.6	300.5
Operation & Maintenance	7.7	1.1	19.5	19.9	6.8	50.3	105.3
Sludge Disposal	215.2	14.7	-	-	4.3	-	234.2
Energy and Power(1)	-	0.3	25.6(2)	1.3	2.9	25.6	30.1
Chemical Costs	-	-	-	-	-	-	-
TOTAL	254.3	20.6	99.0	102.6	41.6	281.3	799.4
Credit for Sludge Recovery	1864.0	-	-	-	16.6	-	1880.6
Credit for Oil Recovery	-	21.0	-	-	-	-	21.0
TOTAL	-1609.7	-0.4	99.0	102.6	25.0	281.3	-1102.2

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	1092	692
Suspended Solids	7560	13
Oil & Grease	145	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Clarifier
B: Oil Skimming	E: Vacuum Filter
C: Recycle	F: Filtration

TABLE VIII-11

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Primary
: Carbon
: With Scarfers

Model Size-TPD : 6620
Oper. Days/Year: 260
Turns/Days : 3

C&TT Steps	A	B	C	D	E	F	Total
Investment $ X 10^{-3}	210.9	222.4	528.1	508.4	170.0	1587	3226.8
Annual Cost $ X 10^{-3}							
Capital	9.1	9.6	22.7	21.9	7.3	68.2	138.8
Depreciation	21.1	22.2	52.8	51.0	17.0	158.7	322.8
Operation & Maintenance	7.4	0.8	18.5	17.8	5.9	55.6	106.0
Sludge Disposal	136.7	9.5	-	-	3.3	-	149.5
Energy and Power(1)	-	0.4	22.0(2)	0.7	2.1	28.3	31.5
Chemical Costs	-	-	-	-	-	-	-
TOTAL	174.3	42.5	94.0	91.4	35.6	310.8	748.6
Credit for Sludge Recovery	1184.5	-	-	-	12.8	-	1197.3
Credit for Oil Recovery	-	13.5	-	-	-	-	13.5
TOTAL	-1010.2	29.0	94.0	91.4	22.8	310.8	-462.2

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	1334	845
Suspended Solids	4270	13
Oil & Grease	160	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-12

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Primary
: Specialty

Model Size-TPD : 1440
Oper. Days/Year: 260
Turns/Days : 3

C&TT Steps	A	B	C	D	E	F	Total
Investment \$ X 10^{-3}	126.2	16.5	353.9	291.3	94.8	981.8	1864.5
Annual Cost \$ X 10^{-3}							
Capital	5.4	0.7	15.2	12.5	4.1	45.7	83.6
Depreciation	12.6	1.7	35.4	29.0	9.5	98.2	186.4
Operation & Maintenance	4.4	0.6	12.4	10.2	3.3	34.4	65.3
Sludge Disposal	51.9	2.9	-	-	1.2	-	56.0
Energy and Power(1)	-	0.3	8.6(2)	0.4	1.6	18.6	20.9
Chemical Costs	-	-	-	-	-	-	-
TOTAL	74.3	6.2	63.0	52.1	19.7	196.9	412.2
Credit for Sludge Recovery	449.9	-	-	-	4.5	-	454.4
Credit for Oil Recovery	-	4.1	-	-	-	-	4.1
TOTAL	-375.6	2.1	63.0	52.1	15.2	196.9	-46.3

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	1912	1220
Suspended Solids	2640	13
Oil & Grease	100	10
pH, Units	6-9	6-9

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(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-13

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Section
: Carbon

Model Size-TPD : 2920
Oper. Days/Year: 260
Turns/Days : 3

C&TT Steps	A	B	C	D	E	F	Total
Investment $ X 10^{-3}	328	412	777	792	200	1165	3674
Annual Cost $ X 10^{-3}							
Capital	14.1	17.7	33.4	34.1	8.6	50.1	158.0
Depreciation	32.8	41.2	77.7	79.2	20.0	116.5	367.4
Operation & Maintenance	11.5	1.4	27.2	27.7	7.0	40.8	115.6
Sludge Disposal	75.4	22.4	-	-	1.8	-	99.6
Energy and Power(1)	-	0.6	34.9(2)	1.2	2.6	20.8	25.2
Chemical Costs	-	-	-	-	-	-	-
TOTAL	133.8	83.3	138.3	142.2	40.0	228.2	765.8
Credit for Sludge Recovery	653.0	-	-	-	8.2	-	661.2
Credit for Oil Recovery	-	32.1	-	-	-	-	32.1
TOTAL	-519.2	51.2	138.3	142.2	31.8	228.2	72.5

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	6029	2626
Suspended Solids	840	22
Oil & Grease	32	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-14

BPT MODEL CEST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Section
: Specialty

Model Size-TPD : 1475
Oper. Days/Year: 260
Turns/Days : 3

C&TT Steps	A	B	C	D	E	F	Total
Investment \$ X 10^{-3}	257	33.7	722	594	114	1757	3477.7
Annual Cost \$ X 10^{-3}							
Capital	11.0	1.4	31.0	25.5	4.8	75.6	149.3
Depreciation	25.7	3.4	72.2	59.4	11.4	175.7	347.8
Operation & Maintenance	9.1	1.2	25.2	20.8	3.9	61.5	121.7
Sludge Disposal	55.0	10.3	-	-	0.8	-	66.1
Energy and Power(1)	-	0.5	17.5(2)	0.9	1.4	31.3	34.1
Chemical Costs	-	-	-	-	-	-	-
TOTAL	100.8	16.8	128.4	106.6	22.3	344.1	719.0
Credit for Sludge Recovery	476.0	-	-	-	3.8	-	479.8
Credit for Oil Recovery	-	14.6	-	-	-	-	14.6
TOTAL	-375.2	2.2	128.4	106.6	18.5	344.1	224.6

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	6029	2626
Suspended Solids	840	22
Oil & Grease	32	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-15

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Hot Forming	Model Size-TPD :	6165
:	Flat	Oper. Days/Year:	260
:	Hot Strip & Sheet	Turns/Days :	3

C&TT Steps	A	B	C	D	E	F	Total
Investment \$ X 10^{-3}	712	108	1863	4132	429	1643	8887
Annual Cost \$ X 10^{-3}							
Capital	30.6	4.6	80.1	178.0	18.4	70.6	382.3
Depreciation	71.2	10.8	186.0	413.0	42.9	164.3	888.2
Operation & Maintenance	25.0	3.8	65.2	145.0	15.0	57.5	311.5
Sludge Disposal	89.7	-	-	-	12.6	-	102.3
Energy and Power(1)	-	0.7	138.4(2)	4.2	6.9	26.9	38.7
Chemical Costs	-	-	-	-	-	-	-
TOTAL	216.5	19.9	331.3	740.2	95.8	319.3	1723.0
Credit for Sludge Recovery	777.0	-	-	-	56.9	-	833.9
Credit for Oil Recovery	-	95.8	-	-	-	-	95.8
TOTAL	-560.5	-75.9	331.3	740.2	38.9	319.3	793.3

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	8015	4180
Suspended Solids	630	19
Oil & Grease	24	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-16

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Hot Forming	Model Size-TPD :	3485
:	Flat	Oper. Days/Year:	260
:	Plate	Turns/Days :	3
:	Carbon		

C&TT Steps	A	B	C	D	E	F	Total
Investment \$ X 10^{-3}	481	38.3	1086	1138	304	2378	5425.3
Annual Cost \$ X 10^{-3}							
Capital	20.7	1.7	46.7	48.9	13.1	102.2	233.3
Depreciation	48.1	3.8	109.0	113.0	30.4	237.8	542.1
Operation & Maintenance	16.8	1.3	38.0	39.8	1.1	83.2	180.2
Sludge Disposal	41.5	11.0	-	-	3.6	-	56.1
Energy and Power(1)	-	0.5	44.2(2)	1.8	4.0	39.0	45.3
Chemical Costs	-	-	-	-	-	-	-
TOTAL	127.1	18.3	193.7	203.5	52.2	462.2	1057.0
Credit for Sludge Recovery	359.0	-	-	-	16.1	-	375.1
Credit for Oil Recovery	-	15.7	-	-	-	-	15.7
TOTAL	-231.9	2.6	193.7	203.5	36.1	462.2	666.2

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	5500	4000
Suspended Solids	920	10
Oil & Grease	35	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.

(2) Total cost does not include power, because a credit is supplied for existing process water requirements.

(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A:	Primary Scale Pit	D:	Clarifier
B:	Oil Skimming	E:	Vacuum Filter
C:	Recycle	F:	Filtration

TABLE VIII-17

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Hot Forming	Model Size-TPD :	1065
:	Flat	Oper. Days/Year:	260
:	Plate	Turns/Days :	3
:	Specialty		

C&TT Steps	A	B	C	D	E	F	Total
Investment \$ X 10^{-3}	509	125	1427	859	519	2906	6345
Annual Cost \$ X 10^{-3}							
Capital	21.9	5.4	14.6	36.9	22.3	124.9	226.0
Depreciation	50.9	12.5	142.0	85.9	51.9	290.6	633.8
Operation & Maintenance	17.8	4.4	50.0	30.1	18.2	101.7	222.2
Sludge Disposal	20.1	2.4	-	-	0.8	-	23.3
Energy and Power(1)	-	1.1	10.9(2)	3.3	2.5	47.6	54.5
Chemical Costs	-	-	-	-	-	-	-
TOTAL	110.7	25.8	206.6	156.2	95.7	564.8	1159.8
Credit for Sludge Recovery	174.0	-	-	-	3.4	-	177.4
Credit for Oil Recovery	-	3.4	-	-	-	-	3.4
TOTAL	-63.3	22.4	206.6	156.2	92.3	564.8	979.0

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	12,879	9366
Suspended Solids	390	10
Oil & Grease	15	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.

(2) Total cost does not include power, because a credit is supplied for existing process water requirements.

(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-18

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory:	Hot Forming	Model Size-TPD :	965
:	Pipe & Tube	Oper. Days/Year:	260
:	Carbon	Turns/Days :	3

C&TT Steps	A	B	C	D	E	F	Total
Investment \$ X 10^{-3}	168	19.2	390	561	149	261	1548.2
Annual Cost \$ X 10^{-3}							
Capital	7.2	0.8	16.8	24.1	6.4	11.2	66.5
Depreciation	16.8	1.9	39.0	56.1	14.9	26.1	154.8
Operation & Maintenance	5.9	0.6	13.6	19.6	5.2	9.2	54.1
Sludge Disposal	43.2	-	-	-	1.6	-	44.8
Energy and Power(1)	-	0.2	9.4(2)	0.9	2.1	3.0	6.2
Chemical Costs	-	-	-	-	-	-	-
TOTAL	73.1	3.5	69.4	100.7	30.2	49.5	326.4
Credit for Sludge Recovery	373.9	-	-	-	7.4	-	381.3
Credit for Oil Recovery	7.1	-	-	-	-	-	7.1
TOTAL	-307.9	3.5	69.4	100.7	22.8	49.5	-62.0

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	4209	1002
Suspended Solids	1200	34
Oil & Grease	15	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.

(2) Total cost does not include power, because a credit is supplied for existing process water requirements.

(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-19

BPT MODEL COST DATA: BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Pipe & Tube
: Specialty

Model Size-TPD : 460
Oper. Days/Year: 260
Turns/Days : 3

C&TT Steps	A	B	C	D	E	F	Total
Investment $ X 10^{-3}	113	19	306	359	75.3	396.5	1268.8
Annual Cost $ X 10^{-3}							
Capital	4.8	0.8	13.1	15.4	3.2	17.1	54.4
Depreciation	11.3	1.9	30.6	35.9	7.5	39.7	126.9
Operation & Maintenance	3.9	0.6	10.7	12.6	2.6	13.9	44.3
Sludge Disposal	17.6	-	-	-	0.7	-	18.3
Energy and Power(1)	-	0.3	4.7(2)	0.6	0.9	4.5	6.3
Chemical Costs	-	-	-	-	-	-	-
TOTAL	37.6	3.6	54.4	64.5	14.9	75.2	250.2
Credit for Sludge Recovery	152.0	-	-	-	3.0	-	155.0
Credit for Oil Recovery	-	2.9	-	-	-	-	2.9
TOTAL	-114.4	0.7	54.4	64.5	11.9	75.2	92.3

Effluent Quality(3)	Raw Waste Level	BPT Effluent Level
Flow, gal/ton	4209	1002
Suspended Solids	1200	34
Oil & Grease	15	10
pH, Units	6-9	6-9

---

(1) Costs are all power unless otherwise noted.
(2) Total cost does not include power, because a credit is supplied for existing process water requirements.
(3) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Oil Skimming
C: Recycle
D: Clarifier
E: Vacuum Filter
F: Filtration

TABLE VIII-20

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory: Hot Forming
: Primary
: Without Scarfing
: Carbon

Model Size-TPD : 4400
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $\$ \times 10^{-3}$	1773	893	2666	34	241	2941
Annual Cost $\$ \times 10^{-3}$						
Capital	76.2	38.4	114.6	1.5	10.4	126.5
Depreciation	177.3	89.3	266.6	3.4	24.1	294.1
Operation & Maintenance	62.1	31.3	93.4	1.2	8.4	103.0
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	69.8	46.5(2)	69.8	0.1	1.3	71.2
Chemical Costs	-	-	-	1.8	-	1.8
TOTAL	385.4	159.0(2)	544.4	8.0	44.2	596.6

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	2300	90	90
	Susp. Solids	15	15	15
	Oil & Grease	5	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.1	0.1	0.1
128	Zinc	0.1	0.1	0.1

---

(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-21

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	6700
:	Primary	Oper. Days/Year:	260
:	Without Scarfing	Turns/Day :	3
:	Carbon		

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment \$ x 10^{-3}	1440	777	314	2531	41	2572
Annual Cost \$ x 10^{-3}						
Capital	61.9	33.4	13.5	108.8	1.8	110.6
Depreciation	144.0	77.7	31.4	253.1	4.1	257.2
Operation & Maintenance	50.4	27.2	11.0	88.6	1.4	90.0
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	58.2	34.9(2)	1.9	60.1	0.2	60.3
Chemical Costs	-	-	-	-	2.7	2.7
TOTAL	314.5	138.3(2)	57.8	510.6	10.2	520.8

Effluent Quality(3)		BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	1150	90	90
	Suspended Solids	30	15	15
	Oil & Grease	10	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.2	0.1	0.1
128	Zinc	0.1	0.1	0.1

---

(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower	I: Filtration
H: Recycle to process increased to 96%	J: Precipitation using sulfide

TABLE VIII-22

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 1 TYPE

Subcategory: Hot Forming
: Primary
: With Scarfing
: Carbon

Model Size-TPD : 2200
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $ x 10^{-3}	807	573	1380	34	241	1655
Annual Cost $ x 10^{-3}						
Capital	34.7	24.6	59.3	1.5	10.4	71.2
Depreciation	80.7	57.3	138.0	3.4	24.1	165.5
Operation & Maintenance	28.3	20.0	48.3	1.2	8.4	57.9
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	32.0	17.5(2)	32.0	0.1	1.3	33.4
Chemical Costs	-	-	-	1.8	-	1.8
TOTAL	175.7	101.9(2)	277.6	8.0	44.2	329.8

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	1700	140	140
	Suspended Solids	15	15	15
	Oil & Grease	5	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.1	0.1	0.1
128	Zinc	0.1	0.1	0.1

---

(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G - Cooling Tower
H - Recycle to process increased to 96%
J - Precipitation using sulfide
K - Filtration

TABLE VIII-23

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	4400
:	Primary	Oper. Days/Year:	260
:	With Scarfing	Turns/Day :	3
:	Carbon		

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $\$x10^{-3}$	2265	1121	3386	41	293	3720
Annual Cost $\$x10^{-3}$						
Capital	97.4	48.2	145.6	1.8	12.6	160.0
Depreciation	226.5	112.1	338.6	4.1	29.3	372.0
Operation & Maintenance	79.3	39.2	118.5	1.4	10.3	130.2
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	110.5	69.8(2)	110.5	0.2	1.9	112.6
Chemical Costs	-	-	-	2.8	-	2.8
TOTAL	513.7	199.5(2)	713.2	10.3	54.1	777.6

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	3400	140	140
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-24

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory: Hot Forming
: Primary
: With Scarfing
: Carbon

Model Size-TPD : 6700
Oper. Days/Year: 260
Turns/day : 3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment $ x 10^{-3}	1881	1058	426	3365	47	3412
Annual Cost $ x 10^{-3}						
Capital	80.9	45.5	18.3	144.7	2.0	146.7
Depreciation	188.1	105.8	42.6	336.5	4.7	341.2
Operation & Maintenance	65.8	37.0	14.9	117.7	1.6	119.3
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	81.4	58.2(2)	2.4	83.8	0.2	84.0
Chemical Costs	-	-	-	-	4.2	4.2
TOTAL	416.2	188.3(2)	78.2	682.7	12.7	695.4

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	1700	140	140
	Suspended Solids	30	15	15
	Oil & Grease	10	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.2	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-25

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	3000
:	Primary	Oper. Days/Year:	260
:	Without Scarfing	Turns/day :	3
:	Specialty		

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $ x 10^{-3}	1384	771	2155	33	178	2366
Annual Cost $ x 10^{-3}						
Capital	59.5	33.2	92.7	1.4	7.7	101.8
Depreciation	138.4	77.1	215.5	3.3	17.8	236.6
Operation & Maintenance	48.4	27.0	75.4	1.1	6.2	82.7
Sludge Disposal	-	-	-	-	-	-
Energy and Power (1)	52.3	29.1 (2)	52.3	0.1	1.0	53.4
Chemical Costs	-	-	-	1.2	-	1.2
TOTAL	298.6	137.3 (2)	435.9	7.1	32.7	475.7

Effluent Quality (3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	2300	90	90
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G:	Cooling Tower	J:	Precipitation using sulfide
H:	Recycle to process at 96%	K:	Filtration

TABLE VIII-26

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	1350
:	Primary	Oper. Days/Year:	260
:	Without Scarfing	Turns/Day :	3
:	Specialty		

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment \$ x 10^{-3}	472	320	118	910	27	937
Annual Cost \$ x 10^{-3}						
Capital	20.3	13.8	5.1	39.2	1.2	40.4
Depreciation	47.2	32.0	11.8	91.0	2.7	93.7
Operation & Maintenance	16.5	11.2	4.1	31.8	1.0	32.8
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	14.5	7.0(2)	0.4	14.9	0.1	15.0
Chemical Costs	-	-	-	-	0.5	0.5
TOTAL	98.5	57.0(2)	21.4	176.9	5.5	182.4

Effluent Quality(3)		BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	1150	90	90
	Suspended Solids	30	15	15
	Oil & Grease	10	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.2	0.1	0.1
129	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-27

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	1350
:	Primary	Oper. Days/Year:	260
:	With Scarfing	Turns/Day :	3
:	Specialty		

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment \$ x 10^{-3}	605	402	143	1150	29	1179
Annual Cost\$ x 10^{-3}						
Capital	26.0	17.3	6.2	49.5	1.2	50.7
Depreciation	60.5	40.2	14.3	115.0	2.9	117.9
Operation & Maintenance	21.2	14.1	5.0	40.3	1.0	41.3
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	23.3	11.6(2)	0.7	24.0	0.1	24.1
Chemical Costs	-	-	-	-	0.9	0.9
TOTAL	131.0	71.6(2)	26.2	228.8	6.1	234.9

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	1700	140	140
Suspended Solids	30	15	15
Oil & Grease	10	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.2	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-28

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 1 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	970
:	Section	Oper. Days/Year:	260
:	Carbon	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment \$ x 10^{-3}	614	404	1018	29	135	1182
Annual Cost \$ x 10^{-3}						
Capital	26.4	17.4	43.8	1.2	5.8	50.8
Depreciation	61.4	40.4	101.8	2.9	13.5	118.2
Operation & Maintenance	21.5	14.1	35.6	1.0	4.7	41.3
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	23.3	11.6(2)	23.3	0.1	0.7	24.1
Chemical Costs	-	-	-	0.9	-	0.9
TOTAL	132.6	71.9(2)	204.5	6.1	24.7	235.3

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	2550	200	200
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-29

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	3340
:	Section	Oper. Days/Year:	260
:	Carbon	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $ x 10^{-3}	2507	1316	3823	42	340	4205
Annual Cost $ x 10^{-3}						
Capital	107.8	56.6	164.4	1.8	14.6	180.8
Depreciation	250.7	131.6	382.3	4.2	34.0	420.5
Operation & Maintenance	87.8	46.1	133.9	1.5	11.9	147.3
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	110.5	69.8(2)	110.5	0.2	1.9	112.6
Chemical Costs	-	-	-	3.0	-	3.0
TOTAL	556.8	234.3(2)	791.1	10.7	62.4	864.2

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	5100	200	200
	Suspended Solids	15	15	15
	Oil & Grease	5	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.1	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-30

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	2900
:	Section	Oper. Days/Year:	260
:	Carbon	Turns/Day :	3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment \$ x 10^{-3}	1440	777	314	2531	41	2572
Annual Cost \$ x 10^{-3}						
Capital	61.9	33.4	13.5	108.8	1.8	110.6
Depreciation	144.0	77.7	31.4	253.1	4.1	257.2
Operation & Maintenance	50.4	27.2	11.0	88.6	1.4	90.0
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	58.2	34.9(2)	1.9	60.1	0.2	60.3
Chemical Costs	-	-	-	-	2.6	2.6
TOTAL	314.5	138.3(2)	57.8	510.6	10.1	520.7

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	2550	200	200
Suspended Solids	30	15	15
Oil & Grease	10	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.2	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-31

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 1 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	1600
:	Section	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment \$ x 10^{-3}	614	404	1018	29	135	1182
Annual Cost \$ x 10^{-3}						
Capital	26.4	17.4	43.8	1.2	5.8	50.8
Depreciation	61.4	40.4	101.8	2.9	13.5	118.2
Operation & Maintenance	21.5	14.1	35.6	1.0	4.7	41.3
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	23.3	11.6(2)	23.3	0.1	0.7	24.1
Chemical Costs	-	-	-	0.9	-	0.9
TOTAL	132.6	71.9(2)	204.5	6.1	24.7	235.3

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	1600	130	130
	Suspended Solids	15	15	15
	Oil & Grease	5	5	5
	pH, Units	6-9	6-9	6-9
118	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.1	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-32

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	1800
:	Section	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment \$ x 10^{-3}	1029	672	1701	32	205	1938
Annual Cost \$ x 10^{-3}						
Capital	44.3	28.9	73.2	1.4	8.8	83.4
Depreciation	102.9	67.2	170.1	3.2	20.5	193.8
Operation & Maintenance	36.0	23.5	59.5	1.1	7.2	67.8
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	40.7	23.3(2)	40.7	0.1	0.7	41.5
Chemical Costs	-	-	-	1.0	-	1.0
TOTAL	223.9	119.6(2)	343.5	6.8	37.2	387.5

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	3200	130	130
	Suspended Solids	15	15	15
	Oil & Grease	5	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.1	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-33

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory: Hot Forming
: Section
: Specialty

Model Size-TPD : 1400
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment $\$ \times 10^{-3}$	603	400	143	1146	27	1173
Annual Cost $\$ \times 10^{-3}$						
Capital	25.9	17.2	6.2	49.3	1.2	50.5
Depreciation	60.3	40.0	14.3	114.6	2.7	117.3
Operation & Maintenance	21.1	14.0	5.0	40.1	1.0	41.1
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	23.3	11.6(2)	0.7	24.0	0.1	24.1
Chemical Costs	-	-	-	-	0.8	0.8
TOTAL	130.6	71.2(2)	26.2	228.0	5.8	233.8

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	1600	130	130
Suspended Solids	30	15	15
Oil & Grease	10	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.2	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-34

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 1 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	13200
:	Flat-Hot Strip & Sheet	Oper. Days/Year:	260
:	Carbon-Specialty	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $ x 10^{-3}	5156	2339	7495	83	910	8488
Annual Cost $ x 10^{-3}						
Capital	221.6	100.6	322.2	3.5	39.1	364.8
Depreciation	515.6	233.9	749.5	8.3	91.0	848.8
Operation & Maintenance	180.5	81.8	262.3	2.9	31.8	297.0
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	349.0	279.2(2)	349.0	0.7	11.9	361.6
Chemical Costs	-	-	-	18.3	-	18.3
TOTAL	1266.7	416.3(2)	1683.0	33.7	173.8	1890.5

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	4480	260	260
	Suspended Solids	15	15	15
	Oil & Grease	5	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.1	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-35

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory: Hot Forming
: Flat-Hot Strip & Sheet
: Carbon-Specialty

Model Size-TPD : 5900
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment \$ x 10^{-3}	3804	1950	5754	57	561	6372
Annual Cost \$ x 10^{-3}						
Capital	163.6	83.8	247.4	2.5	24.1	274.0
Depreciation	380.4	195.0	575.4	5.7	56.1	637.2
Operation & Maintenance	133.1	68.2	201.3	2.0	19.6	222.9
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	244.3	174.5(2)	244.3	0.2	3.7	248.2
Chemical Costs	-	-	-	6.9	-	6.9
TOTAL	921.4	347.0(2)	1268.4	17.3	103.5	1389.2

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	6400	260	260
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-36

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	5800
:	Flat-Hot Strip & Sheet	Oper. Days/Year:	260
:	Carbon-Specialty	Turns/Day :	3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment $ x 10^{-3}	3076	1617	566	5259	57	5316
Annual Cost $ x 10^{-3}						
Capital	132.3	69.5	24.3	226.1	2.5	228.6
Depreciation	307.6	161.7	56.6	525.9	5.7	531.6
Operation & Maintenance	107.7	56.6	19.8	184.1	2.0	186.1
Sludge Disposal	-	-	-	-	-	-
Energy and Power (1)	180.3	116.3 (2)	3.7	184.0	0.2	184.2
Chemical Costs	-	-	-	-	6.8	6.8
TOTAL	727.9	287.8 (2)	104.4	1120.1	17.2	1137.3

Effluent Quality (3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	4480	260	260
Suspended Solids	30	15	15
Oil & Grease	10	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.2	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower

H: Recycle to process increased to 96%

I: Filtration

J: Precipitation using sulfide

TABLE VIII-37

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	6900
:	Flat Plate	Oper. Days/Year:	260
:	Carbon	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment $ x 10^{-3}	2897	1584	4481	47	417	4945
Annual Cost $ x 10^{-3}						
Capital	124.6	68.1	192.7	2.0	17.9	212.6
Depreciation	289.7	158.4	448.1	4.7	41.7	494.5
Operation & Maintenance	101.4	55.4	156.8	1.6	14.6	173.0
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	168.7	104.7(2)	168.7	0.1	2.4	171.2
Chemical Costs	-	-	-	4.3	-	4.3
TOTAL	684.4	281.9(2)	966.3	12.7	76.6	1055.6

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	3400	140	140
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-38

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	2800
:	Flat Plate	Oper. Days/Year:	260
:	Carbon	Turns/Day :	3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment \$ x 10^{-3}	1316	744	250	2310	34	2344
Annual Cost \$ x 10^{-3}						
Capital	56.6	32.0	10.8	99.4	1.5	100.9
Depreciation	131.6	74.4	25.0	231.0	3.4	234.4
Operation & Maintenance	46.1	26.0	8.8	80.9	1.2	82.1
Sludge Disposal	-	-	-	-	-	-
Energy & Power(1)	52.3	29.1(2)	1.3	53.6	0.1	53.7
Chemical Costs	-	-	-	-	1.8	1.8
TOTAL	286.6	132.4(2)	45.9	464.9	8.0	472.9

	Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	2380	140	140
	Suspended Solids	30	15	15
	Oil & Grease	10	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.2	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-39

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory: Hot Forming
: Flat Plate
: Specialty

Model Size-TPD : 3600
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	G	H	Total	J	K	Total Incl. G&H
Investment \$ x 10^{-3}	994	665	1659	31	193	1883
Annual Cost \$ x 10^{-3}						
Capital	42.8	28.6	71.4	1.4	8.3	81.1
Depreciation	99.4	66.4	165.9	3.1	19.3	188.3
Operation & Maintenance	34.8	23.3	58.1	1.1	6.8	66.0
Sludge Disposal	-	-	-	-	-	-
Energy and Power (1)	40.7	23.3 (2)	40.7	0.1	0.7	41.5
Chemical Costs	-	-	-	1.0	-	1.0
TOTAL	217.7	118.4 (2)	336.1	6.7	35.1	377.9

Effluent Quality (3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	1500	60	60
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process at 96%
J: Precipitation using sulfide
K: Filtration

TABLE VIII-40

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	220
:	Flat Plate	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	G	H	I	Total	J	Total Incl. G-I
Investment $ x 10^{-3}	140	121	57	318	21	339
Annual Cost $ x 10^{-3}						
Capital	6.0	5.2	2.4	13.6	0.9	14.5
Depreciation	14.0	12.1	5.7	31.8	2.1	33.9
Operation & Maintenance	4.9	4.2	2.0	11.1	0.7	11.8
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	3.8	1.2(2)	0.1	3.9	0.1	4.0
Chemical Costs	-	-	-	-	0.1	0.1
TOTAL	28.7	21.5(2)	10.2	60.4	3.9	64.3

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	1050	60	60
Suspended Solids	30	15	15
Oil & Grease	10	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.2	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

G: Cooling Tower
H: Recycle to process increased to 96%
I: Filtration
J: Precipitation using sulfide

TABLE VIII-41

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 1 TYPE

Subcategory: Hot Forming
: Pipe & Tube
: Carbon

Model Size-TPD : 822
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	H	I	Total	K	L	Total Incl. H&I
Investment \$ x 10^{-3}	605	135	740	28	135	903
Annual Cost \$ x 10^{-3}						
Capital	26.0	5.8	31.8	1.2	5.8	38.8
Depreciation	60.5	13.5	74.0	2.8	13.5	90.3
Operation & Maintenance	21.2	4.7	25.9	1.0	4.7	31.6
Sludge Disposal	-	-	-	-	-	-
Energy and Power (1)	23.3	11.6 (2)	23.3	0.1	0.7	24.1
Chemical Costs	-	0	0	0.8	-	0.8
TOTAL	131.0	24.0 (2)	155.0	5.9	24.7	185.6

Effluent Quality (3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	2760	220	220
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.

(2) Total does not include power cost as a credit is supplied for existing process water requirements.

(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

H: Cooling Tower
I: Recycle to process increased to 96%
K: Precipitation using sulfide
L: Filtration

TABLE VIII-42

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory: Hot Forming
: Pipe & Tube
: Carbon

Model Size-TPD : 547
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	H	I	Total	K	L	Total Incl. H&I
Investment \$ x 10^{-3}	689	478	1167	27	117	1311
Annual Cost \$ x 10^{-3}						
Capital	29.6	20.6	50.2	1.2	5.0	56.4
Depreciation	68.9	47.8	116.7	2.7	11.7	131.1
Operation & Maintenance	24.1	16.7	40.8	1.0	4.1	45.9
Sludge Disposal	-	-	-	-	-	-
Energy and Power (1)	26.2	14.5 (2)	26.2	0.1	0.4	26.7
Chemical Costs	-	-	-	0.5	-	0.5
TOTAL	148.8	85.1 (2)	233.9	5.5	21.2	260.6

Effluent Quality (3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	5520	220	220
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

H: Cooling Tower
I: Recycle to process at 96%
K: Precipitation using sulfide
L: Filtration

TABLE VIII-43

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory: Hot Forming — Model Size-TPD : 1036
: Pipe & Tube — Oper. Days/Year: 260
: Carbon — Turns/Day : 3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	H	I	J	Total	K	Total Incl. H-J
Investment $ x 10^{-3}	674	472	181	1327	32	1359
Annual Cost $ x 10^{-3}						
Capital	29.0	20.3	7.8	57.1	1.4	58.5
Depreciation	67.4	47.2	18.1	132.7	3.2	135.9
Operation & Maintenance	23.6	16.5	6.3	46.4	1.1	47.5
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	26.2	11.6(2)	0.7	26.9	0.1	27.0
Chemical Costs	-	-	-	-	1.0	1.0
TOTAL	146.2	84.0(2)	32.9	263.1	6.8	269.9

Effluent Quality(3)		BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
	Flow, gal/ton	2760	220	220
	Suspended Solids	30	15	15
	Oil & Grease	10	5	5
	pH, Units	6-9	6-9	6-9
119	Chromium	0.1	0.1	0.1
120	Copper	0.1	0.1	0.1
122	Lead	0.1	0.1	0.1
124	Nickel	0.2	0.1	0.1
128	Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

H: Cooling Tower
I: Recycle to process increased to 96%
J: Filtration
K: Precipitation using sulfide

TABLE VIII-44

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 2 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	1195
:	Pipe & Tube	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1			2 - Alt. 1 Plus:		
C&TT Step	H	I	Total	K	L	Total Incl. H&I
Investment $ x 10^{-3}	1316	744	2060	33	178	2271
Annual Cost $ x 10^{-3}						
Capital	56.6	32.0	88.6	1.4	7.7	97.7
Depreciation	131.6	74.4	206.0	3.3	17.8	227.1
Operation & Maintenance	46.1	26.0	72.1	1.1	6.2	79.4
Sludge Disposal	-	-	-	-	-	-
Energy and Power(1)	52.3	29.1(2)	52.3	0.1	1.0	53.4
Chemical Costs	-	-	-	1.2	-	1.2
TOTAL	286.6	132.4(2)	419.0	7.1	32.7	458.8

Effluent Quality(3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	5520	220	220
Suspended Solids	15	15	15
Oil & Grease	5	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

H: Cooling Tower
I: Recycle to process at 96%
K: Precipitation using sulfide
L: Filtration

TABLE VIII-45

BAT MODEL COST DATA-BASIS 7/1/78 DOLLARS
BAT FEED SYSTEM: MODEL 3 TYPE

Subcategory:	Hot Forming	Model Size-TPD :	338
:	Pipe & Tube	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1				2 - Alt. 1 Plus:	
C&TT Step	H	I	J	Total	K	Total Incl. H-J
Investment $\$ \times 10^{-3}$	298	246	106	650	25	675
Annual Cost $\$ \times 10^{-3}$						
Capital	12.8	10.6	4.6	28.0	1.1	29.1
Depreciation	29.8	24.6	10.6	65.0	2.5	67.5
Operation & Maintenance	10.4	8.6	3.7	22.7	0.9	23.6
Sludge Disposal	-	-	-	-	-	-
Energy and Power (1)	9.3	4.7 (2)	0.3	9.6	0.1	9.7
Chemical Costs	-	-	-	-	0.3	0.3
TOTAL	62.3	43.8 (2)	19.2	125.3	4.9	130.2

Effluent Quality (3)	BAT Feed Level	BAT No. 1 Effluent Level	BAT No. 2 Effluent Level
Flow, gal/ton	2760	220	220
Suspended Solids	30	15	15
Oil & Grease	10	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	0.1	0.1	0.1
120 Copper	0.1	0.1	0.1
122 Lead	0.1	0.1	0.1
124 Nickel	0.1	0.1	0.1
128 Zinc	0.1	0.1	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for existing process water requirements.
(3) All values are mg/l unless otherwise noted.

KEY TO C&TT STEPS

H: Cooling Tower	J: Filtration
I: Recycle to process increased to 96%	K: Precipitation using sulfide

TABLE VIII-46

BAT ALTERNATIVE NO. 1 COST SUMMARY
HOT FORMING SUBCATEGORY

Subdivision	Flow Rates (gal/ton)		BAT Costs ($ x 10^{-6})		Adjusted BAT Costs ($ x 10^{-6})(1)	
	BAT Feed	Discharge	Capital	Annual	Capital	Annual
PRIMARY						
a. Carbon						
w/o scarfers	2,300	90	71.0	14.3	44.0	8.9
w/scarfers	3,400	140	102.4	20.8	63.5	12.9
b. Specialty						
w/o scarfers	2,300	90	14.9	2.9	11.3	2.2
w/scarfers	3,400	140	3.5	0.7	2.7	0.5
SECTION						
a. Carbon	5,100	200	179.5	36.5	149.0	30.3
b. Specialty	3,200	130	21.1	4.7	17.5	3.9
FLAT						
a. Hot Strip & Sheet	6,400	260	227.8	48.9	200.5	43.0
b. Plate (Carbon)	3,400	140	32.1	6.6	22.5	4.6
c. Plate (Specialty)	1,500	60	2.6	0.5	2.5	0.5
PIPE & TUBE						
a. Carbon	5,520	220	30.8	6.5	19.0	3.4
b. Specialty	5,520	220	5.3	1.0	3.3	0.6
			692.2	154.4	535.5	110.8

---

(1) These costs have been adjusted by applying co-mingling factors which reduce the overall costs by taking into account cost reductions achieved by the use of central treatment systems. For more information on these factors, see footnotes (1) and (2) in Table VIII-9A.

TABLE VIII-47

BAT ALTERNATIVE NO. 2 COST SUMMARY HOT FORMING SUBCATEGORY

Subdivision	Flow Rate (gal/ton)	BAT Costs ($ x 10^{-6}) Capital	BAT Costs ($ x 10^{-6}) Annual	Adjusted BAT Costs(1) ($ x 10^{-6}) Capital	Adjusted BAT Costs(1) ($ x 10^{-6}) Annual
PRIMARY					
a. Carbon					
w/o scarfers	90	72.5	14.7	45.0	9.1
w/scarfers	140	104.7	21.4	64.9	13.3
b. Specialty					
w/o scarfers	90	15.5	3.0	11.8	2.3
w/scarfers	140	3.6	0.7	2.7	0.5
SECTION					
a. Carbon	200	186.5	37.9	154.8	31.5
b. Specialty	130	24.6	4.9	20.4	4.1
FLAT					
a. Hot Strip & Sheet	260	234.9	50.5	206.7	44.4
b. Plate (Carbon)	140	33.4	6.9	23.4	4.8
c. Plate (Specialty)	60	2.9	0.6	2.8	0.6
PIPE & TUBE					
a. Carbon	220	32.0	6.4	17.6	3.5
b. Specialty	220	5.6	1.1	3.5	0.7
		716.2	148.1	554.3	114.8

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(1) These costs have been adjusted by applying co-mingling factors which reduce the overall costs by taking into account cost reductions achieved by the use of central treatment systems. For information on these factors, see footnotes (1) and (2) in Table VIII-9A.

TABLE VIII-48

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY (BCT) ANALYSIS
HOT FORMING SUBCATEGORY

	OLD BPT					BCT FEEDS (NEW DATA BASE)							BCT		Industry BCT Costs	
	Model Size (TPD)	Applied Flow (GPT)	Discharge Flow (GPT)	Conc. (mg/l) TSS	Conc. (mg/l) O&G	Model No.(4)	Model Size (TPD)	Number of Plants	Applied Flow (GPT)	BCT Applied Flow (GPT)	Conc. (mg/l) TSS	Conc. (mg/l) O&G	Discharge Flow (GPT)(1)	Cost ($/lb)(2)	Capital Cost $x10^{-6} (3)	Annual Cost $x10^{-6} (3)
PRIMARY																
a. Carbon w/o scarfers	4000	1092	692	13	10	1	-	0	-	-	-	-	-	0.54	71.0	14.3
						2	4400	1	2300	2300	15	5	90			
						3	6700	27	2300	1150	30	10	90			
w/scarfers	4000	1334	845	13	10	1	2200	1	3400	1700	15	5	140		102.4	20.8
						2	4400	2	3400	3400	15	5	140			
						3	6700	28	3400	1700	30	10	140			
b. Specialty w/o scarfers	2364	1912	1220	13	10	1	-	0	-	-	-	-	-		14.9	2.9
						2	3000	1	2300	2300	15	5	90			
						3	1350	14	2300	1150	30	10	90			
w/scarfers	2364	1912	1220	13	10	1	-	0	-	-	-	-	-		3.5	0.7
						2	-	0	-	-	-	-	-			
						3	1350	3	3400	1700	30	10	140			
SECTION																
a. Carbon	1300	6029	2626	22	10	1	970	2	5100	2550	15	5	200	0.46	179.5	36.5
						2	3340	12	5100	5100	15	5	200			
						3	2900	52	5100	2550	30	10	200			
b. Specialty	360	6029	2626	22	10	1	1600	1	3200	1600	15	5	130		23.3	4.7
						2	1800	3	3200	3200	15	5	130			
						3	1400	15	3200	1600	30	10	130			
FLAT																
a. Hot Strip & Sheet	3800(5) 2041(6)	8015	4180	19	10	1	13,200	2	6400	4480	15	5	260	0.63	227.8	48.9
						2	5900	5	6400	6400	15	5	260			
						3	5800	35	6400	4480	30	10	260			
b. Plate (Carbon)	2000	5500	4000	10	10	1	-	0	-	-	-	-	-			
						2	6900	2	3400	3400	15	5	140	0.94	32.1	6.6
						3	2800	10	3400	2380	30	10	140			
c. Plate (Specialty)	578	12,879	9366	10	10	1	-	0	-	-	-	-	-			
						2	3600	1	1500	1500	15	5	60	0.98	2.6	0.5
						3	220	3	1500	1050	30	10	60			

TABLE VIII-48
HOT FORMING SUBCATEGORY
BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY (BCT) ANALYSIS
PAGE 2

	OLD BPT					BCT FEEDS (NEW DATA BASE)							BCT		Industry BCT Costs	
	Model Size (TPD)	Applied Flow (GPT)	Discharge Flow (GPT)	Conc. (mg/1) TSS	Conc. (mg/1) O&G	Model No.(4)	Model Size (TPD)	Number of Plants	Applied Flow (GPT)	BCT Applied Flow (GPT)	Conc. (mg/1) TSS	Conc. (mg/1) O&G	Discharge Flow (GPT)(1)	Cost ($/lb)(2)	Capital Cost $x10^{-6} (3)	Annual Cost $x10^{-6} (3)
PIPE & TUBE(7)																
a. Carbon	400	4209	1002	34	10	1	822	1	5520	2760	15	5	220			
						2	547	3	5520	5520	15	5	220		30.8	6.1
						3	1036	20	5520	2760	30	10	270			
b. Specialty	400	4209	1002	34	10	1	-	0	-	-	-	-	-	0.89		
						2	1195	1	5520	5520	15	5	220		5.3	1.0
						3	338	5	5520	2760	30	10	220			

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(1) All models at: TSS at 15 mg/1; O&G at 5 mg/1
(2) Proposed BPT to Proposed BCT (Δ Adjusted Annual $ ÷Δ CP Load)
(3) Total dollars to BCT

(4) Model 1: PSP,RUP,CL,VF,F
Model 2: PSP,CL,VF,F
Model 3: PSP,RUP,CL,VF
(5) This model size was for Carbon HS & S plants
(6) This model size was for Specialty HS & [illegible] plants
(7) Originally, the Pipe & Tube subcategory was split into isolated and integrated facilities

TABLE VIII-49

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Primary
: Without Scarfers
: Carbon

Model Size-TPD : 6620
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $ x 10^{-3}	332	35	832	801	268	1430	771	312	4781	41	4822
Annual Cost $ x 10^{-3}											
Capital	14.3	1.5	35.8	34.5	11.5	61.4	33.2	13.4	205.6	1.8	207.4
Depreciation	33.2	3.5	83.2	80.1	26.8	143.0	77.1	31.2	478.1	4.1	482.2
Operation & Maintenance	11.6	1.2	29.1	28.0	9.4	50.0	27.0	10.9	167.3	1.4	168.7
Sludge Disposal	215.4	-	-	-	5.2	-	-	-	220.6	-	220.6
Energy & Power(1)	-	0.6	34.6(2)	1.2	3.4	57.8	34.6(2)	1.9	64.9	0.2	65.1
Chemical Costs	-	-	-	-	-	-	-	-	-	2.7	-
Oil Disposal	-	14.9	-	-	-	-	-	-	14.9	-	14.9
TOTAL	274.5	21.7	148.1(2)	143.8	56.3	312.2	137.3(2)	57.4	1151.4	10.2	1158.9
Less Credit	1866.6(4)	21.3(5)			20.2(4)				1908.1		1908.1
NET TOTAL	-1592.1	0.4			36.1				-756.7		-749.2

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	2300	90	90
Suspended Solids	2190	15	15
Oil & Grease	84	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	2.9	0.1	0.1
120 Copper	2.9	0.1	0.1
122 Lead	1.5	0.1	0.1
124 Nickel	1.4	0.1	0.1
128 Zinc	3.2	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-50

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory:			
Subcategory:	Hot Forming	Model Size-TPD :	6410
:	Primary	Oper. Days/Year:	260
:	With Scarfers	Turns/Day :	3
:	Carbon		

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	$D^{(3)}$	$E^{(3)}$	F	G	H	Total	I	Total
Investment Cost $ x 10^{-3}	389	56	984	1007	342	1832	1030	415	6055	46	6101
Annual Cost $ x 10^{-3}											
Capital	16.7	2.4	42.3	43.3	14.7	78.8	44.3	17.8	260.4	2.0	262.4
Depreciation	38.9	5.6	98.4	100.7	34.2	183.2	103.0	41.5	605.5	4.6	610.1
Operation & Maintenance	13.6	1.9	34.5	35.2	12.0	64.1	36.1	14.5	211.9	1.6	213.5
Sludge Disposal	381.0	-	-	-	7.5	-	-	-	388.5	-	388.5
Energy & Power(1)	-	0.6	45.3(2)	2.3	5.1	79.3	56.7(2)	2.3	89.6	0.2	89.8
Chemical Costs	-	-	-	-	-	-	-	-	-	4.1	4.1
Oil Disposal	-	26.0	-	-	-	-	-	-	26.0	-	26.0
TOTAL	450.2	36.5	175.2(2)	181.5	73.5	405.4	183.4(2)	76.1	1581.9	12.5	1594.4
Less Credit	-3299.9(4)	37.1(5)			29.4(4)				-3233.4		-3233.4
NET TOTAL	-2849.7	-0.6			44.1				-1651.5		-1639.0

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	2300	140	140
Suspended Solids	2970	15	15
Oil & Grease	56	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	3.9	0.1	0.1
120 Copper	3.9	0.1	0.1
122 Lead	2.1	0.2	0.1
124 Nickel	1.8	0.1	0.1
128 Zinc	4.4	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Surface Skimming
C: Recycle
D: Roughing Clarifier
E: Vacuum Filter
F: Cooling Tower
G: Recycle
H: Filtration
I: Precipitation with sulfide

TABLE VIII-51

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Primary
: Without Scarfers
: Specialty

Model Size-TPD : 1460
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $ x 10^{-3}	150	22	407	333	134	495	335	124	2000	28	2028
Annual Cost $ x 10^{-3}											
Capital	6.5	0.9	17.5	14.3	5.8	21.3	14.4	5.3	86.0	1.2	87.2
Depreciation	15.0	2.2	40.7	33.3	13.4	49.5	33.5	12.4	200.0	2.8	202.8
Operation & Maintenance	5.3	0.8	14.2	11.7	4.7	17.3	11.7	4.3	70.0	1.0	71.0
Sludge Disposal	36.8	-	-	-	1.1	-	-	-	37.9	-	37.9
Energy & Power(1)	-	0.4	7.3(2)	0.6	2.3	15.2	7.3(2)	0.4	18.9(2)	0.1	19.0(2)
Chemical Costs	-	-	-	-	-	-	-	-	-	0.5	0.5
Oil Disposal	-	2.1	-	-	-	-	-	-	2.1	-	2.1
TOTAL	63.6	6.4	72.4(2)	59.9	27.3	103.3	59.6(2)	22.4	414.9	5.6	420.5
Less Credit	318.6(4)	3.0(5)			4.3(4)				325.9		325.9
NET TOTAL	-255.0	3.4			23.0				89.0		94.6

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	2300	90	90
Suspended Solids	2190	15	15
Oil & Grease	84	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	2.9	0.1	0.1
120 Copper	2.9	0.1	0.1
122 Lead	1.5	0.2	0.1
124 Nickel	4.9	0.1	0.1
128 Zinc	1.6	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-52

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Primary
: With Scarfers
: Specialty

Model Size-TPD : 1350
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $ x 10^-3	171	22	478	394	128	605	402	143	2343	29	2372
Annual Cost $ x 10^-3											
Capital	7.3	1.0	20.6	16.9	5.5	26.0	17.3	6.2	100.7	1.2	101.9
Depreciation	17.1	2.2	47.8	39.4	12.8	60.5	40.2	14.3	234.3	2.9	237.2
Operation & Maintenance	6.0	0.8	16.7	13.8	4.5	21.1	14.1	5.0	82.0	1.0	83.0
Sludge Disposal	70.2	-	-	-	1.6	-	-	-	71.8	-	71.8
Energy & Power(1)	-	0.3	11.6(2)	0.6	2.2	23.3	11.6(2)	0.7	27.1	0.1	27.2
Chemical Costs	-	-	-	-	-	-	-	-	-	0.9	0.9
Oil Disposal	-	3.9	-	-	-	-	-	-	3.9	-	3.9
TOTAL	100.6	8.2	85.1(2)	70.7	26.6	131.0	71.6(2)	26.2	519.8	6.1	525.9
Less Credit	607.9(4)	5.5(5)			6.1(4)				619.5		619.5
NET TOTAL	-507.3	2.7			20.5				-99.7		-93.6

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	3400	140	140
Suspended Solids	2970	15	15
Oil & Grease	56	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	3.9	0.1	0.1
120 Copper	3.9	0.1	0.1
122 Lead	2.1	0.2	0.1
124 Nickel	6.6	0.1	0.1
128 Zinc	2.2	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-53

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Section
: Carbon

Model Size-TPD : 2920
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D$^{(3)}$	E$^{(3)}$	F	G	H	Total	I	Total
Investment Cost \$ x 10^{-3}	329	41	780	796	201	1446	780	315	4688	41	4729
Annual Cost \$ x 10^{3}											
Capital	14.1	1.8	33.5	34.2	8.6	62.2	33.5	13.6	201.6	1.8	203.4
Depreciation	32.9	4.1	78.0	79.6	20.1	144.6	78.0	31.5	468.8	4.1	472.9
Operation & Maintenance	11.5	1.4	27.3	27.8	7.0	50.6	27.3	11.0	164.1	1.4	165.5
Sludge Disposal	75.7	-	-	-	1.8	-	-	-	77.5	-	77.5
Energy & Power$^{(1)}$	-	0.6	35.0$^{(2)}$	1.2	2.6	58.4	35.0$^{(2)}$	1.9	64.7	0.2	64.9
Chemical Costs	-	-	-	-	-	-	-	-	-	2.6	2.6
Oil Disposal	-	22.6	-	-	-	-	-	-	22.6	-	22.6
TOTAL	134.2	30.5	138.8$^{(2)}$	142.8	40.1	315.8	138.8$^{(2)}$	58.0	999.3	10.1	1009.4
Less Credit	655.7$^{(4)}$	32.2$^{(5)}$			8.2$^{(4)}$				696.1		696.1
NET TOTAL	-521.5	-1.7							303.2		313.3

Effluent Quality$^{(6)}$	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	5100	200	200
Suspended Solids	990	15	15
Oil & Grease	38	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	1.3	0.1	0.1
120 Copper	1.3	0.1	0.1
122 Lead	0.68	0.2	0.1
124 Nickel	0.61	0.1	0.1
128 Zinc	1.5	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-54

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory:	Hot Forming	Model Size-TPD :	1470
:	Section	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $ x 10^{-3}	176	23	492	405	78	621	412	147	2354	28	2382
Annual Cost $ x 10^{-3}											
Capital	7.5	1.0	21.2	17.4	3.3	26.7	17.7	6.3	101.2	1.2	102.4
Depreciation	17.6	2.3	49.2	40.5	7.8	62.1	41.2	14.7	235.4	2.8	238.2
Operation & Maintenance	6.1	0.8	17.2	14.2	2.7	21.7	14.4	5.2	82.4	1.0	83.4
Sludge Disposal	37.5	-	-	-	0.6	-	-	-	38.1	-	38.1
Energy & Power(1)	-	0.4	12.0(2)	0.6	1.0	24.0	11.9(2)	0.7	26.7	0.1	26.8
Chemical Costs	-	-	-	-	-	-	-	-	-	0.8	0.8
Oil Disposal	-	7.0	-	-	-	-	-	-	7.0	-	7.0
TOTAL	68.7(4)	11.5(5)	87.6(2)	72.7	15.4(4)	134.5	73.3(2)	26.9	490.8	5.9	496.7
Less Credit	324.6	10.0			2.5				337.1		337.1
NET TOTAL	-255.9	1.5			12.9				153.7		159.6

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	3200	130	130
Suspended Solids	1580	15	15
Oil & Grease	60	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	2.1	0.1	0.1
120 Copper	2.1	0.1	0.1
122 Lead	1.1	0.2	0.1
124 Nickel	3.5	0.1	0.1
128 Zinc	1.2	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-55

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Flat
: Hot Strip & Sheet
: Carbon-Specialty

Model Size-TPD : 6160
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $\$ \times 10^{-3}$	621	94	1623	3600	374	3189	1676	587	11,764	59	11,823
Annual Cost $\$ \times 10^{3}$											
Capital	26.7	4.1	69.8	154.8	16.1	137.1	72.1	25.2	505.9	2.5	508.3
Depreciation	62.1	9.4	162.3	360.0	37.4	318.9	167.6	58.7	1176.4	5.9	1179.3
Operation & Maintenance	21.7	3.3	56.8	126.0	13.1	111.6	58.7	20.5	411.7	2.1	413.8
Sludge Disposal	78.2	-	-	-	11.0	-	-	-	89.2	-	89.2
Energy & Power(1)	-	0.6	120.6(2)	3.6	6.0	186.9	120.6	3.8	321.5	0.2	321.7
Chemical Costs	-	-	-	-	-	-	-	-	-	7.1	7.1
Oil Disposal	-	58.5	-	-	-	-	-	-	58.5	-	58.5
TOTAL	188.7	75.9	288.9(2)	644.4	83.6	754.5	298.4(2)	108.2	2563.2	17.8	2577.9
Less Credit	677.0(4)	83.5(5)			49.5(4)				810.0		810.0
NET TOTAL	-488.3	-7.6			34.1				1753.2		1767.9

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	6400	260	260
Suspended Solids	790	15	15
Oil & Grease	30	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	1.0	0.1	0.1
120 Copper	1.0	0.1	0.1
122 Lead	0.54	0.2	0.1
124 Nickel	1.1	0.1	0.1
128 Zinc	0.87	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-56

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Flat
: Plate
: Carbon

Model Size-TPD : 3480
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $\$ \times 10^{-3}$	361	29	814	853	228	3505	1842	645	8277	65	8342
Annual Cost $\$ \times 10^{3}$											
Capital	15.5	1.2	35.0	36.7	9.8	150.7	79.2	27.7	355.9	2.8	358.7
Depreciation	36.1	2.9	81.4	85.3	22.8	350.5	184.2	64.5	827.7	6.5	834.2
Operation & Maintenance	12.6	1.0	28.5	29.9	8.0	122.7	64.5	22.6	289.7	2.3	292.0
Sludge Disposal	31.1	-	-	-	2.7	-	-	-	33.8	-	33.8
Energy & Power(1)	-	0.4	33.1(2)	1.3	3.0	205.4	132.5(2)	4.2	214.3	0.2	214.5
Chemical Costs	-	-	-	-	-	-	-	-	-	7.7	7.7
Oil Disposal	-	8.2	-	-	-	-	-	-	8.2	-	8.2
TOTAL	95.3	13.7	144.9(2)	153.2	46.3	829.3	327.9(2)	119.0	1729.6	19.5	1749.1
Less Credit	269.4(4)	11.8(5)			12.1(4)				293.3		293.3
NET TOTAL	-174.1	1.9			34.2				1436.3		1455.8

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	3400	140	140
Suspended Solids	1480	15	15
Oil & Grease	56	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	1.9	0.1	0.1
120 Copper	1.9	0.1	0.1
122 Lead	1.0	0.2	0.1
124 Nickel	0.92	0.1	0.1
128 Zinc	2.2	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Surface Skimming
C: Recycle
D: Roughing Clarifier
E: Vacuum Filter
F: Cooling Tower
G: Recycle
H: Filtration
I: Precipitation with sulfide

TABLE VIII-57

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Flat
: Plate
: Specialty

Model Size-TPD : 1060
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost \$ x 10^{-3}	117	17	318	260	105	387	266	97	1567	23	1590
Annual Cost \$ x 10^{-3}											
Capital	5.0	0.7	13.7	11.2	4.5	16.6	11.4	4.1	67.4	1.0	68.4
Depreciation	11.7	1.7	31.8	26.0	10.5	38.7	26.6	9.7	156.7	2.3	159.0
Operation & Maintenance	4.1	0.6	11.1	9.1	3.7	13.5	9.0	3.4	54.8	0.8	55.6
Sludge Disposal	28.7	-	-	-	0.9	-	-	-	29.6	-	29.6
Energy & Power(1)	-	0.3	5.7(2)	0.5	1.8	11.9	5.8(2)	0.3	14.8	0.1	14.9
Chemical Costs	-	-	-	-	-	-	-	-	-	0.3	0.3
Oil Disposal	-	1.7	-	-	-	-	-	-	1.7	-	1.7
TOTAL	49.5	5.0	56.6(2)	46.8	21.4	80.7	47.0(2)	17.5	325.0	4.5	329.5
Less Credit	248.9(4)	2.4(5)			3.4(4)				254.7		254.7
NET TOTAL	-199.4	2.6			18.0				70.3		74.8

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	1500	60	60
Suspended Solids	3360	15	15
Oil & Grease	130	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	4.4	0.1	0.1
120 Copper	4.4	0.1	0.1
122 Lead	2.3	0.2	0.1
124 Nickel	7.4	0.1	0.1
128 Zinc	2.5	0.25	0.1

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(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Surface Skimming
C: Recycle
D: Roughing Clarifier
E: Vacuum Filter
F: Cooling Tower
G: Recycle
H: Filtration
I: Precipitation with sulfide

TABLE VIII-58

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory: Hot Forming
: Pipe & Tube
: Carbon

Model Size-TPD : 970
Oper. Days/Year: 260
Turns/Day : 3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D(3)	E(3)	F	G	H	Total	I	Total
Investment Cost $ x 10^{-3}	200	23	463	665	177	648	454	174	2804	31	2835
Annual Cost $ x 10^{-3}											
Capital	8.6	1.0	19.9	28.6	7.6	27.8	19.5	7.5	120.6	1.3	121.9
Depreciation	20.0	2.3	46.3	66.5	17.7	64.8	45.4	17.4	280.4	3.1	283.5
Operation & Maintenance	7.0	0.8	16.2	23.3	6.2	22.7	15.9	6.1	98.1	1.1	99.2
Sludge Disposal	51.2	-	-	-	1.9	-	-	-	53.1	-	53.1
Energy & Power(1)	-	0.3	11.2(2)	1.1	2.5	25.2	11.2(2)	0.7	29.8	0.1	29.9
Chemical Costs	-	-	-	-	-	-	-	-	-	1.0	1.0
Oil Disposal	-	5.9	-	-	-	-	-	-	5.9	-	5.9
TOTAL	86.8	10.3	82.4(2)	119.5	35.9	140.5	80.8(2)	31.7	587.9	6.6	594.5
Less Credit	443.7(4)	8.5(5)			8.8(4)				461.0		461.0
NET TOTAL	-356.9	1.8			27.1				126.9		133.5

Effluent Quality(6)	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	5520	220	220
Suspended Solids	210	15	15
Oil & Grease	35	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	1.2	0.1	0.1
120 Copper	1.2	0.1	0.1
122 Lead	0.63	0.2	0.1
124 Nickel	0.57	0.1	0.1
128 Zinc	1.3	0.25	0.1

---

(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit
B: Surface Skimming
C: Recycle
D: Roughing Clarifier
E: Vacuum Filter
F: Cooling Tower
G: Recycle
H: Filtration
I: Precipitation with sulfide

TABLE VIII-59

NSPS MODEL COST DATA-BASIS 7/1/78 DOLLARS

Subcategory:	Hot Forming	Model Size-TPD :	480
:	Pipe & Tube	Oper. Days/Year:	260
:	Specialty	Turns/Day :	3

Alternative	1									2 - Alt. No. 1 Plus:	
C&TT Step	A	B	C	D[3]	E[3]	F	G	H	Total	I	Total
Investment Cost $ x 10^{-3}	139	23	377	443	93	368	304	131	1878	31	1909
Annual Cost $ x 10^{-3}											
Capital	6.0	1.0	16.2	19.1	4.0	15.8	13.1	5.6	80.8	1.3	82.1
Depreciation	13.9	2.3	37.7	44.3	9.3	36.8	30.4	13.1	187.8	3.1	190.9
Operation & Maintenance	4.9	0.8	13.2	15.5	3.3	12.9	10.6	4.6	65.7	1.1	66.8
Sludge Disposal	21.7	-	-	-	0.8	-	-	-	22.5	-	22.5
Energy & Power[1]	-	0.4	5.7[2]	0.7	1.1	11.5	5.8[2]	0.4	14.1	0.1	14.2
Chemical Costs	-	-	-	-	-	-	-	-	-	0.4	0.4
Oil Disposal	-	2.5	-	-	-	-	-	-	2.5	-	2.5
TOTAL	46.5	7.0	67.1[2]	79.6	18.5	77.0	54.1[2]	23.7	373.4	6.0	379.4
Less Credit	187.6[4]	3.6[5]		3.7[4]					194.9		194.9
NET TOTAL	-141.1	3.4			14.8				178.5		184.5

Effluent Quality[6]	Raw Waste Level	NSPS No.1 Effluent Level	NSPS No.2 Effluent Level
Flow, gal/ton	5520	220	220
Suspended Solids	910	15	15
Oil & Grease	35	5	5
pH, Units	6-9	6-9	6-9
119 Chromium	1.2	0.1	0.1
120 Copper	1.2	0.1	0.1
122 Lead	0.63	0.2	0.1
124 Nickel	2.0	0.1	0.1
128 Zinc	0.67	0.25	0.1

---

(1) Costs are all power unless otherwise noted.
(2) Total does not include power cost as a credit is supplied for process water requirements.
(3) Treatment components are used in tandem.
(4) Credit for recovery of solids to sinter plant.
(5) Credit for recovery of oil.
(6) All values are in mg/l unless otherwise noted.

KEY TO C&TT STEPS

A: Primary Scale Pit	D: Roughing Clarifier	G: Recycle
B: Surface Skimming	E: Vacuum Filter	H: Filtration
C: Recycle	F: Cooling Tower	I: Precipitation with sulfide

TABLE VIII-60

PRETREATMENT MODEL COST DATA

The pretreatment system proposed for hot forming operations is identical to the NSPS Alternative No. 1 treatment system. Therefore, the pretreatment model costs for each hot forming operation are the same as those developed for NSPS Alternative No. 1. For the appropriate pretreatment costs, refer to Tables VIII-49 through VIII-59.

TABLE VIII-61

ENERGY REQUIREMENTS SUMMARY
HOT FORMING SUBCATEGORY

BAT and BCT Treatment Models

	BAT Alternative No. 1/BCT				BAT Alternative No. 2(1)			
Subdivision	kw/hr(2)	Annual(2) Cost	Total(3) kw/hr	Total(3) Annual Cost	kw/hr(2)	Annual(2) Cost	Total(3) kw/hr	Total(3) Annual Cost
PRIMARY								
a. Carbon w/o Scarfing								
Model No. 2	447	$69,800	447	$69,800	456	$71,200	456	$71,200
Model No. 3	385	$60,100	11,935	$1,862,000	386	$60,300	11,969	$1,867,000
b. Carbon w/Scarfing								
Model No. 1	205	$32,000	205	$32,000	214	$33,400	214	$33,400
Model No. 2	708	$110,500	1416	$221,000	721	$112,600	1442	$225,000
Model No. 3	538	$83,800	15,064	$2,350,000	539	$84,000	15,095	$2,355,000
c. Specialty w/o Scarfing								
Model No. 2	336	$52,300	336	$52,300	343	$53,400	343	$53,400
Model No. 3	95.6	$14,900	1338	$209,000	96.4	$15,000	1350	$211,000
d. Specialty w/Scarfing								
Model No. 3	154	$24,000	460	$71,800	154	$24,100	463	$72,200
SECTION								
a. Carbon								
Model No. 1	149	$23,300	298	$46,500	154	$24,100	308	$48,000
Model No. 2	708	$110,500	8496	$1,325,000	721	$112,600	8653	$1,350,000
Model No. 3	385	$60,100	20,020	$3,123,000	386	$60,300	20,077	$3,132,000
b. Specialty								
Model No. 1	149	$23,300	149	$23,300	154	$24,100	154	$24,100
Model No. 2	261	$40,700	783	$122,000	266	$41,500	799	$125,000
Model No. 3	154	$24,000	2302	$359,000	154	$24,100	2314	$361,000

TABLE VIII-61
ENERGY REQUIREMENTS SUMMARY
HOT FORMING SUBCATEGORY
PAGE 2

BAT and BCT Treatment Models

	BAT Alternative No. 1/BCT				BAT Alternative No. 2(1)			
Subdivision	kw/hr(2)	Annual(2) Cost	Total(3) kw/hr	Total(3) Annual Cost	kw/hr(2)	Annual(2) Cost	Total(3) kw/hr	Total(3) Annual Cost
FLAT								
a. Hot Strip and Sheet								
Model No. 1	2237	$349,000	4474	$698,000	2318	$361,600	4635	$723,000
Model No. 2	1566	$244,300	7830	$1,221,000	1592	$248,200	7958	$1,241,000
Model No. 3	1180	$184,000	41,300	$6,443,000	1182	$184,200	41,352	$6,451,000
b. Carbon Plate								
Model No. 2	1081	$168,700	2162	$337,000	1097	$171,200	2195	$342,000
Model No. 3	344	$53,600	3440	$537,000	345	$53,700	3448	$538,000
c. Specialty Plate								
Model No. 2	261	$40,700	261	$40,700	261	$40,700	261	$40,700
Model No. 3	24.8	$3900	74.2	$11,600	25.1	$4000	75.4	$11,800
PIPE AND TUBE								
a. Carbon								
Model No. 1	149	$23,300	149	$23,300	154	$24,100	154	$24,100
Model No. 2	168	$26,200	504	$78,600	171	$26,700	514	$80,200
Model No. 3	172	$26,900	3450	$538,000	173	$27,000	3465	$541,000
b. Specialty								
Model No. 2	336	$52,300	336	$52,300	343	$53,400	343	$53,400
Model No. 3	62	$9600	310	$48,400	62.8	$9700	314	$49,000

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(1) Includes the energy requirements from Alternative No. 1, which is incorporated with Alternative No. 2.
(2) These data are based upon the treatment model.
(3) Treatment model energy requirements expanded to encompass the requirements for the industry.

TABLE VIII-62

SOLID WASTE GENERATION SUMMARY(1)
HOT FORMING SUBCATEGORY

BPT Treatment Models

Subdivision	Pounds/Ton(2)	Pounds/Day(3)	Tons/Year(4)
PRIMARY			
a. Carbon			
w/o scarfers	43.4	286,000	1,190,000
w/scarfers	85.5	393,000	1,580,000
b. Specialty	43.4	62,500	146,000
SECTION			
a. Carbon	43.1	126,000	1,080,000
b. Specialty	43.1	64,600	160,000
FLAT			
a. Hot Strip and Sheet	42.7	265,000	1,450,000
b. Carbon Plate	43.1	151,000	236,000
c. Specialty Plate	41.9	46,000	24,000
PIPE AND TUBE			
a. Integrated or Isolated	43.3	38,000	148,000

---

(1) Includes solids and oils and greases.

(2) Pounds of solid waste per ton of production based on the treatment model.

(3) Pounds of solid waste per day based on the treatment model.

(4) Model solid waste generation data expanded to encompass solid waste generation for the mills within the particular subdivision.

TABLE VIII-63

SOLID WASTE GENERATION SUMMARY(1)
HOT FORMING SUBCATEGORY

BAT and BCT Treatment Models

Subdivision	BAT Alternative No. 1/BCT			BAT Alternative No. 2(2)		
	Pounds/Ton(3)	Pounds/Day(4)	Tons/Year(5)	Pounds/Ton(3)	Pounds/Day(4)	Tons/Year(5)
PRIMARY						
a. Carbon w/o Scarfers						
Model No. 2	0.37	1630	210	0.37	1630	210
Model No. 3	0.37	2480	10,000	0.37	2480	10,000
b. Carbon w/Scarfers						
Model No. 1	0.26	570	74	0.26	570	74
Model No. 2	0.54	2380	620	0.54	2380	620
Model No. 3	0.54	2540	9200	0.54	2540	9200
c. Specialty w/o Scarfers						
Model No. 2	0.37	1110	140	0.37	1110	140
Model No. 3	0.37	500	910	0.37	500	910
d. Specialty w/Scarfers						
Model No. 3	0.54	730	280	0.54	730	280
SECTION						
a. Carbon						
Model No. 1	0.39	380	100	0.39	380	100
Model No. 2	0.82	2740	4300	0.82	2740	4300
Model No. 3	0.82	2380	16,000	0.82	2380	16,000
b. Specialty						
Model No. 1	0.24	380	50	0.24	380	50
Model No. 2	0.51	920	360	0.51	920	360
Model No. 3	0.51	710	1400	0.51	710	1400

TABLE VIII-63
SOLID WASTE GENERATION SUMMARY(1)
HOT FORMING SUBCATEGORY
PAGE 2

BAT and BCT Treatment Models

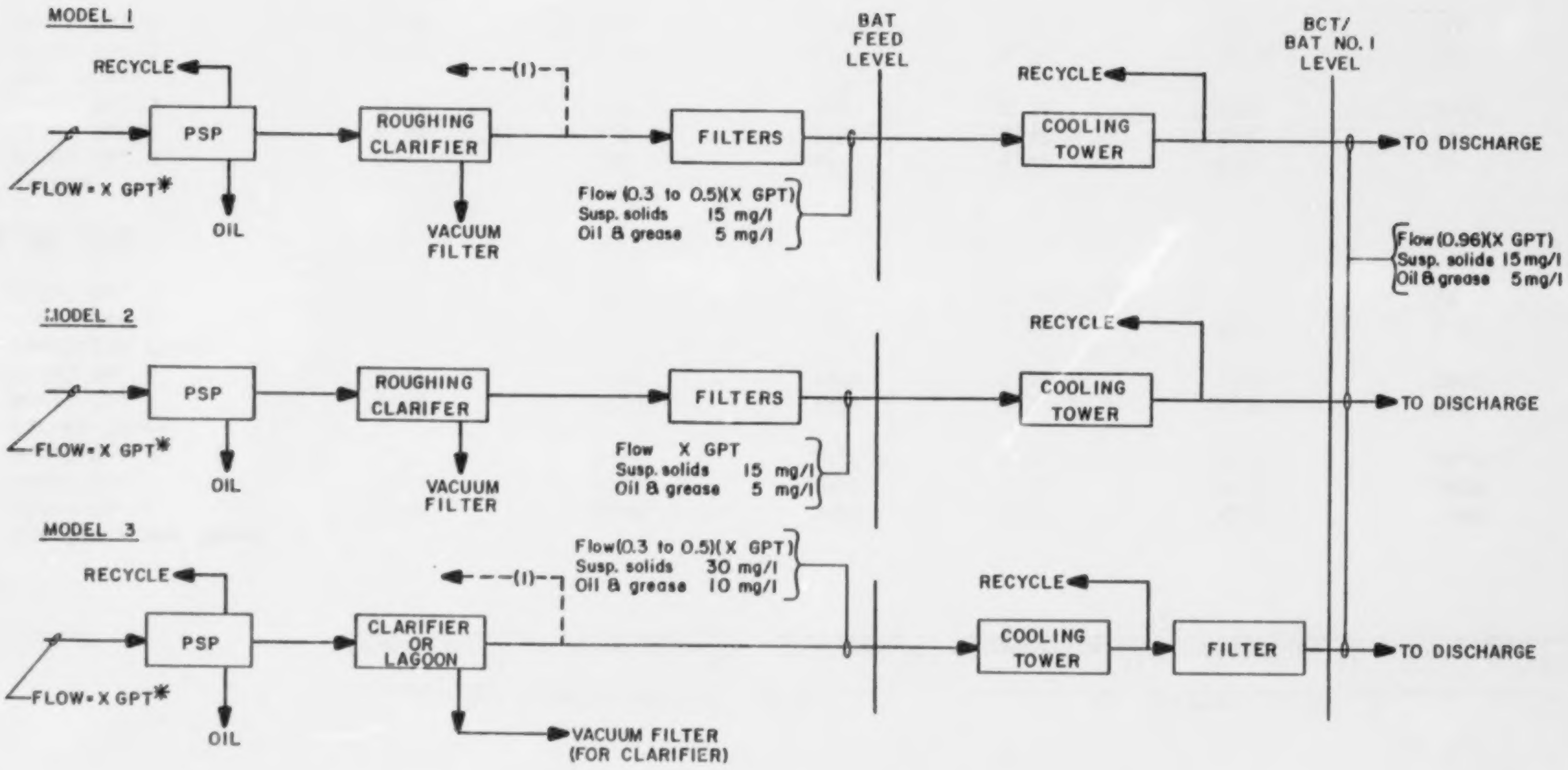
	BAT Alternative No. 1/BCT			BAT Alternative No. 2(2)		
Subdivision	Pounds/Ton(3)	Pounds/Day(4)	Tons/Year(5)	Pounds/Ton(3)	Pounds/Day(4)	Tons/Year(5)
FLAT						
a. Hot Strip and Sheet						
Model No. 1	0.70	9240	2400	0.70	9240	2400
Model No. 2	1.02	6020	3900	1.02	6020	3900
Model No. 3	1.45	8410	38,000	1.45	8410	38,000
b. Carbon Plate						
Model No. 2	0.54	3730	970	0.54	3730	970
Model No. 3	0.77	2160	2800	0.77	2160	2800
c. Specialty Plate						
Model No. 2	0.24	860	110	0.24	860	110
Model No. 3	0.34	75	29	0.34	75	29
PIPE AND TUBE						
a. Carbon						
Model No. 1	0.42	350	46	0.42	350	46
Model No. 2	0.88	480	190	0.88	480	190
Model No. 3	0.88	910	2400	0.88	910	2400
b. Specialty						
Model No. 2	0.88	1050	140	0.88	1050	140
Model No. 3	0.88	300	200	0.88	300	200

---

(1) Includes solids and oils and greases.
(2) Includes the solid wastes generated from Alternative No. 1, which is incorporated in Alternative No. 2.
(3) Pounds of solid waste per ton of production based on the treatment model.
(4) Pounds of solid waste per day based on the treatment model.
(5) Model solid waste generation data expanded to encompass solid waste generation for the mills within the subdivision.

FIGURE VIII-1

BAT FEED TREATMENT MODEL SUMMARY
HOT FORMING SUBCATEGORY


MODEL 1
RECYCLE
PSP
FLOW = X GPT*
OIL
ROUGHING CLARIFIER
VACUUM FILTER
(1)
FILTERS
Flow (0.3 to 0.5)(X GPT)
Susp. solids 15 mg/l
Oil & grease 5 mg/l
BAT FEED LEVEL
RECYCLE
COOLING TOWER
BCT/ BAT NO. 1 LEVEL
TO DISCHARGE
Flow (0.96)(X GPT)
Susp. solids 15 mg/l
Oil & grease 5 mg/l
MODEL 2
PSP
FLOW = X GPT*
OIL
ROUGHING CLARIFER
VACUUM FILTER
FILTERS
Flow X GPT
Susp. solids 15 mg/l
Oil & grease 5 mg/l
RECYCLE
COOLING TOWER
TO DISCHARGE
MODEL 3
RECYCLE
PSP
FLOW = X GPT*
OIL
CLARIFIER OR LAGOON
(1)
VACUUM FILTER (FOR CLARIFIER)
Flow (0.3 to 0.5)(X GPT)
Susp. solids 30 mg/l
Oil & grease 10 mg/l
RECYCLE
COOLING TOWER
FILTER
TO DISCHARGE

* X GPT DESIGNATES THE APPLIED FLOW FOR ANY ONE TYPE OF HF OPERATION

(1) RECYCLE LOCATION FOR HOT WORKING PIPE & TUBE OPERATIONS

(2) NOT ALL MODEL 3 PLANTS HAVE ALL OF THE TREATMENT COMPONENTS SHOWN INSTALLED

HOT FORMING SUBCATEGORY

SECTION IX

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE

The Agency is proposing Best Practical Control Technology Currently Available (BPT) limitations which are the same as those originally promulgated in March, 1976. The subcategories and segments established for the original guidelines are as follows:

- Hot Forming - Primary
  - Carbon Steel Mills Without Scarfers
  - Carbon Steel Mills With Scarfers
  - Specialty Steel Mills

- Hot Forming - Section
  - Carbon and Specialty Steel Mills

- Hot Forming - Flat
  - Hot Strip and Sheet Mill
  - Plate (Carbon Steel) Mills
  - Plate (Specialty Steel) Mills

- Pipe and Tube
  - Integrated Mills
  - Isolated Mills

The March, 1976 development document[1] described the methods used to develop the originally promulgated limitations. The intent of this section is to demonstrate that these limitations are achievable. A review of the treatment processes and limitations associated with the hot forming subcategory follows.

Identification of BPT

The original BPT model treatment systems for primary, section and flat operations included primary scale pits equipped with oil skimming facilities, partial recycle, roughing clarifiers, vacuum filters, and filters. In these models, recycle followed sedimentation of the process wastewaters in primary scale pits with the high blowdown from the partial recycle loop undergoing additional treatment. The BPT model treatment system for integrated hot working pipe and tube operations is similar to the system described above, however; recycle in this system follows sedimentation in a roughing clarifier instead of after the scale pit. Filtration was provided for the recycle blowdown. The model treatment system for isolated pipe and tube operations incorporated a primary scale pit equipped with oil skimming facilities, settling basin, and recycle. Partial recycle followed sedimentation in the settling basin, with the blowdown of the recycle loop receiving no further treatment. Makeup water is required to compensate for system losses in each of the cases presented above.

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[1] EPA-440/I-76/084-b, Development Document for Interim Final Effluent Limitation Guidelines and Proposed New Source Performance Standards for the Forming, Finishing and Specialty Steel Segment of the Iron and Steel Manufacturing Point Source Category.

Figures IX-1 through 3 depict the treatment systems discussed above. Table IX-1 presents a summary of the characteristics of the various hot forming process wastewaters. Sampled plant monitoring data were used to determine the raw wastewater pH values; however, the raw wastewater suspended solids and oil and grease concentrations were determined from information supplied in the D-DCPs (refer to Section VII). Sampled plant monitoring data could not be used for this purpose because, in almost all instances, samples could only be collected following primary scale pits. The proposed BPT effluent limitations, which represent 30-day average limitations, are presented in Table IX-2. The maximum daily effluent limitations are three times the average limitations. The costs associated with the installation of the BPT model treatment systems are presented in Table VIII-9A and 9B.

Rationale for BPT

Treatment System

As noted in Section VII, each of the components of the BPT model treatment systems is in use at many hot forming operations. Thus, the use of each treatment system component is substantiated.

Justification of Proposed BPT Effluent Limitations

Tables IX-3 through IX-9 present sampled plant effluent data which demonstrate that the proposed BPT effluent limitations for each hot forming subcategory and process are achievable.

In reviewing the above tables, it should be noted that the proposed effluent limitations are achieved at many plants which employ modest recycle rates (thus being similar to the BPT model treatment system) and by plants which employ no recycle at all. In addition, the proposed limitations are achieved at plants with discharge flows significantly greater than those presented in the various BPT model treatment systems. The data presented highlight the ability of various plants to attain the desired treatment performance by means other than those specifically incorporated in the BPT model treatment systems. Generally, those sampled plants which do not achieve the proposed effluent limitations have systems in which only preliminary sedimentation is provided. Treatment (and, in some instances, additional recycle) would enable those plants to achieve the proposed BPT effluent limitations. A few plants employing filtration which were sampled did not achieve the proposed effluent limitations; however, these operations have little or no recycle. Therefore, treatment equipment modifications or the use of additional wastewater recycle would enable those operations to achieve the proposed BPT effluent limitations.

TABLE IX-1

BPT MODEL TREATMENT SYSTEM RAW WASTEWATER CHARACTERISTICS
HOT FORMING SUBCATEGORY

OPERATIONS		SUSPENDED[1] SOLIDS (mg/L)	OIL AND[1] GREASE (mg/L)	pH (UNITS)
HOT FORMING (PRIMARY)	(1) Carbon Steel Operations without Scarfing	4,270	160	6-9
	(2) Carbon Steel Operations with Scarfing	7,560	145	6-9
	(3) Specialty Steel Operations	2,640	100	6-9
HOT FORMING (SECTION)	(1) Carbon and Specialty Steel Operations	840	32	6-9
HOT FORMING (FLAT)	(1) Hot Strip and Sheet Operations	630	24	6-9
	(2) Carbon Steel Plate Operations	920	35	6-9
	(3) Specialty Steel Plate Operations	390	15	6-9
HOT FORMING (PIPE AND TUBE)	(1) Carbon and Specialty Steel Operations	1,200	46	6-9

(1) THE LEVELS PRESENTED ON THIS TABLE REPRESENT WASTE LOADS APPLIED TO THOSE PROCESS FLOWS DEVELOPED IN THE ORIGINAL BPT DOCUMENT.

TABLE IX-2

BPT EFFLUENT LIMITATIONS GUIDELINES
HOT FORMING SUBCATEGORY

OPERATION		UNITS	FLOW (gal/ton)	TOTAL SUSPENDED SOLIDS(1)	OIL & GREASE(1)
HOT FORMING (PRIMARY)	(1) Carbon Steel Plants	*/1000*	—	0.0371	0.0288
	w/o Scarfing	MG/L	692	13	10
	(2) w/Scarfing	*/1000*	—	0.0082	0.0064
	Add to (1)	MG/L	153	13	10
	(3) Specialty Steel	*/1000*	—	0.0654	0.0508
	Plants	MG/L	1220	13	10
HOT FORMING (SECTION)	(1) Carbon And	*/1000*	—	0.2420	0.1095
	Specialty Plants	MG/L	2626	22	10
HOT FORMING (FLAT)	(1) Hot Strip	*/1000*	—	0.3308	0.1743
	And Sheet Plants	MG/L	4180	19	10
	(2) Carbon	*/1000*	—	0.1668	0.1668
	Steel Plate	MG/L	4000	10	10
	(3) Specialty	*/1000*	—	0.3760	0.3760
	Steel Plate	MG/L	9366	10	10
HOT FORMING (PIPE & TUBE)	(1) Carbon And	*/1000*	—	0.1418	0.0418
	Specialty Plants	MG/L	1002	34	10

(1) ALL VALUES REPRESENT 30-DAY AVERAGE LIMITATIONS

NOTE: pH IS ALSO LIMITED AT BPT AND IS LIMITED TO 6.0 to 9.0 STANDARD UNITS FOR ALL HOT FORMING OPERATION.

TABLE IX-3

EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION HOT FORMING-PRIMARY (CARBON)

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		692(1) 845(2)	0.0371(1) 0.0453(2)	0.0288(1) 0.0352(2)	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits						
A-2	0112B(2)	520	0.0035	0.0037	7.6-8.0	PSP,SS,SSP,FDP,RTP-42
B-2	0112B(2)	510	0.0049	0.0047	7.7-7.8	PSP,SS,SSP,FDP
C-2(3)	0684H(2)	780	0.016	0.022	7.6-7.7	PSP,CL,FDS
D-2	0946A(2)	460	0.044	0.016	8.1-8.2	PSP,CL,FDP,RTP-35
L-2	0060(2)	10	0.00021	0.00034	8.6-8.7	PSP,FLL,FLP,CL,CT,RTP-98+
082	0496 140"(2)	170	0.00071	0.0085	7.4-7.5	PSP,SSP,DR,FDMG
083	0860H(1)	12	0.00045	0.00050	7.1-7.6	PSP,CL,CT,RTP-96
088(3)	0684H(2)	5	0.00038	0.00018	7.6-7.8	PSP,CL,FDS,RTP-99.7

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(1) Operations without scarfers.
(2) Operations with scarfers - total including (1).
(3) This plant was sampled twice. As C-2 the flow was once-through and as 088, recycle was then in use.

TABLE IX-4

EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION
HOT FORMING-PRIMARY (SPECIALTY)

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		1200	0.0654	0.0508	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits						
E	0020B	2740	0.15	0.023	5.8-6.6	PSP,CL,FDP
M	0432J	68	0.0099	0.0077	5.8-6.3	PSP,SSP,RUP-90,RTP-8.5
081	0176	51(1)	0.0038	0.0021	7.8-8.1	PSP,TP,RTP-94
082	0496					
	140"	170	0.00071	0.0085	7.4-7.5	PSP,SSP,DR,FDMG
	140"/206"	460	0.0019	0.017	7.4	PSP,SSP,DR,FDMG

---

(1) This data represents the discharge from preliminary treatment prior to discharge to central treatment.

TABLE IX-5

EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION
HOT FORMING-SECTION

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		2626	0.2420	0.1095	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits						
M	0432J	140	0.032	0.0058	6.3-6.5	PSP,SS,RTP-80
O	0176-04(1)	320	0.047	0.00094	7.6-8.1	PSP,RTP-97
Q	0684D-02 & 03	1780	0.20	0.010	7.2-7.6	PSP,CNT(45)
A-2	0112B	360	0.0043	0.0043	7.6-8.0	PSP,CL,FDS,RTP-40
E-2	0196A	1640	0.075	0.059	8.3	PSP,CL,FDS,CT,SL(UNK),RTP-65
F-2	0384A-06	140	0.017	0.0048	7.8-8.5	PSP,SSP,SS,CL,FLL,FLP,NW, VF,CT,RTP-98
G-2	0640A-01 & 02	0	0	0	-	PSP,SS,SL(UNK),FD,CT,RTP-100
081	0176-01 to 03(1)	250	0.014	0.0024	7.8-8.1	SSP,SS,TP,CT,RTP-93
083	0860H-02(1)	180	0.00082	0.015	7.1-7.6	PSP,CL,CT,T,CNT,RTP-96.3
083	0860H-03(2)	90	0.023	0.011	7.4	PSP,CL,RTP-99
088	0684H-06 & 07	10	0.00081	0.00068	*	PSP,SSP,SB,CL,T,VF,FLP,RTP-99.7

TABLE IX-5
EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION
HOT FORMING-SECTION
PAGE 2

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		2626	0.2420	0.1095	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits						
088	0684H-02	1.7	0.000012	0.000033	7.6-7.8	PSP,FD(UNK),CL,T,VF,RTP-99.7
088	0684H-01	14	0.000090	0.00016	7.6-7.8	PSP,FD(UNK),CL,T,VF,RTP-99.7
088	0684H-03	2.8	0.000025	0.00018	7.6-7.8	PSP,FD(UNK),CL,T,VF,RTP-99.7
088	0684H-05	10	0.0036	0.00063	7.5	PSP,CT,CL,RUP-44,RTP-53
081	0176-04(1)	340	0.033	0.011	7.7-7.9	SL,RTP-96

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(1) This data represents the discharge from preliminary treatment prior to discharge to central treatment.
(2) This plant eventually achieves a discharge flow rate of 3.5 gal/ton by recycling from a large central treatment system.
*: Level not justified.

TABLE IX-6

EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION HOT FORMING-FLAT (HOT STRIP AND SHEET)

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		4180	0.3308	0.1743	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits						
E	0020B	4520	0.18	0.030	5.8-6.6	PSP,CL,FDS
O	0176	320	0.047	0.00093	7.6-8.1	PSP,RUP-97.5
J-2	0860B	7850	0.26	0.19	7.7-8.3	PSP,SSP,FLP,Filter,CL,VF
L-2	0060	76	0.0016	0.0025	8.6-8.7	PSP,FLL,FLM,CL,VF,CT,RTP-98.3
N-2	0396D	0	0	0	-	PSP,CT,VF,CL,F(UNK)S(UNK),RTP-100
086	0112D-02	5790	0.061	0.020	7.6-7.9	PSP,SS,CL,FLP,NL,NW,CR,SL(UNK)

TABLE IX-7

EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION HOT FORMING-FLAT (CARBON STEEL PLATE)

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		4000	0.1668	0.1668	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits						
K-2	0868B	100	0.0022	0.0026	7.0-7.3	PSP,SSP,T,Filter,CT,RTP-97.3
082	0496					
	112"/120"	870	0.0064	0.064	7.4	PSP,SSP,DR,FDMG
083	0860H	360	0.00011	0.0014	7.1-7.6	PSP,CL,CT,RTP-96.3
086	0112D	3240	0.026	0.021	7.6-7.9	PSP,CL,FLP,SL(UNK)

TABLE IX-8

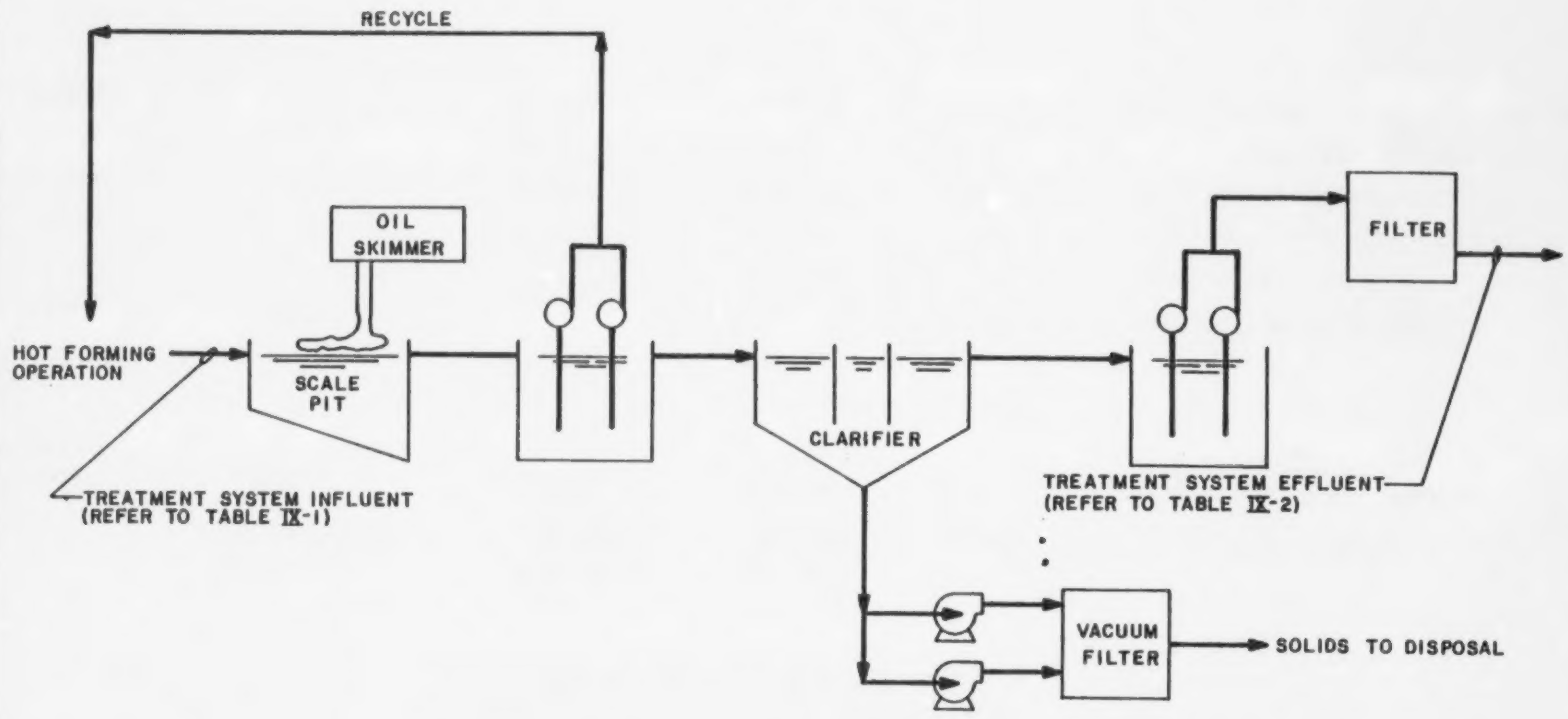
EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION
HOT FORMING-FLAT (SPECIALTY STEEL PLATE)

	Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT	9366	0.3760	0.3760	6-9	PSP,SS,RUP,CL,VF,FDMP
Plant Visits					
082 0496					
112"/120"	2650	0.018	0.23	7.5	PSP,SSP,DR,FDMG

TABLE IX-9

EFFLUENT LOAD (lbs/1000 lbs) JUSTIFICATION HOT WORKING PIPE AND TUBE

		Discharge Flow (gal/ton)	Suspended Solids	Oil and Grease	pH	C&TT Components
Originally Promulgated BPT		1002	0.1418	0.0418	6-9	PSP,SS,CL,VF,RTP,FDMP or PSP,SS,SL,RTP
Plant Visits						
E-2	0196A	4570	0.14	0.22	8.3	PSP,SS,SSP,SS,SL(UNK),CL, FDSP,CT,RTP-64.3
GG-2	0240B	0	0	0	-	PSP, Oil Separator, SL(UNK)
II-2	0916A	2760	0.50	0.026	7.7	PSP,SS,FD(UNK)P,SL(UNK)
JJ-2	0728	0	0	0	-	PSP,SL(UNK),RTP and RET-100
088	0684H	2.8	0.00021	0.00087	7.6-7.8	FDSP,VF,FLL,FLP,CT,CL,T,RTP-99.7

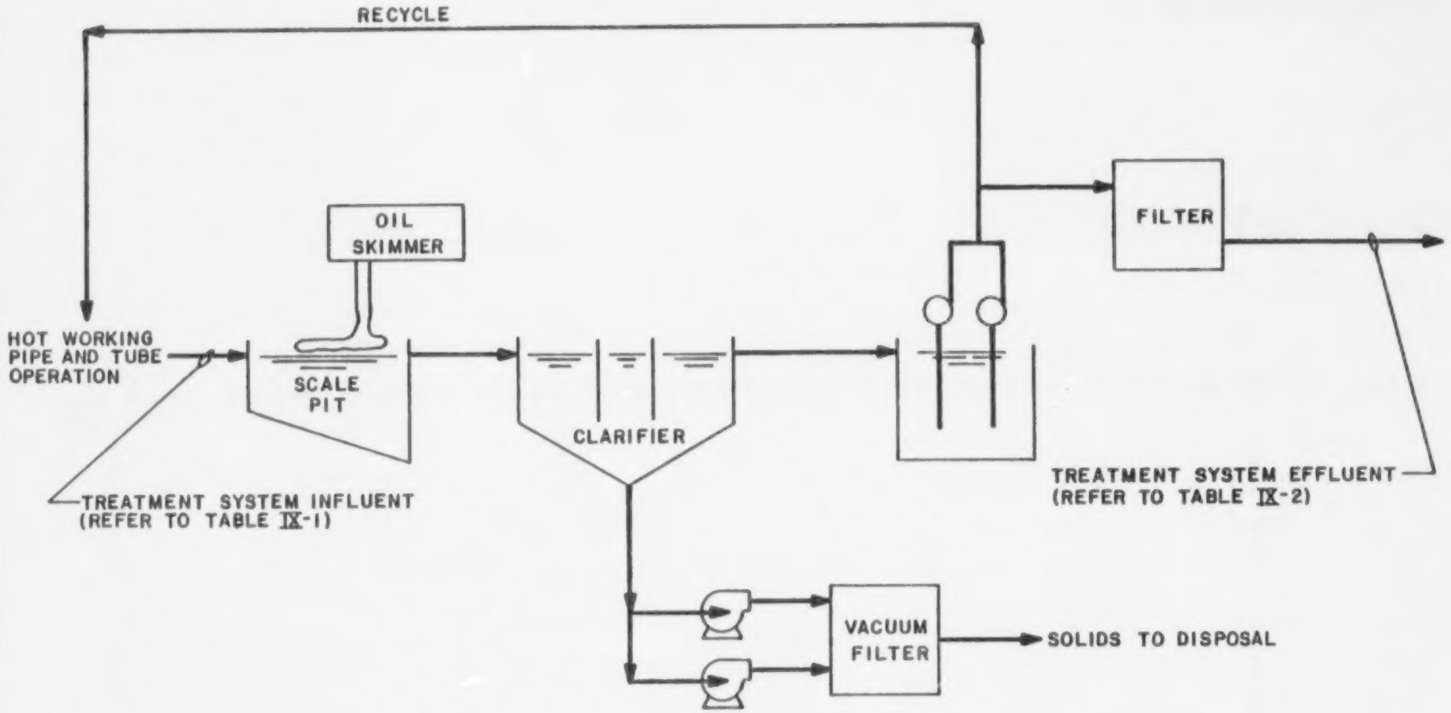

RECYCLE
OIL SKIMMER
HOT FORMING OPERATION
SCALE PIT
TREATMENT SYSTEM INFLUENT (REFER TO TABLE IX-1)
CLARIFIER
TREATMENT SYSTEM EFFLUENT (REFER TO TABLE IX-2)
FILTER
VACUUM FILTER
SOLIDS TO DISPOSAL

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING - PRIMARY,
SECTION AND FLAT
BPT MODEL

Dwn. 1/22/80

FIGURE IX-1



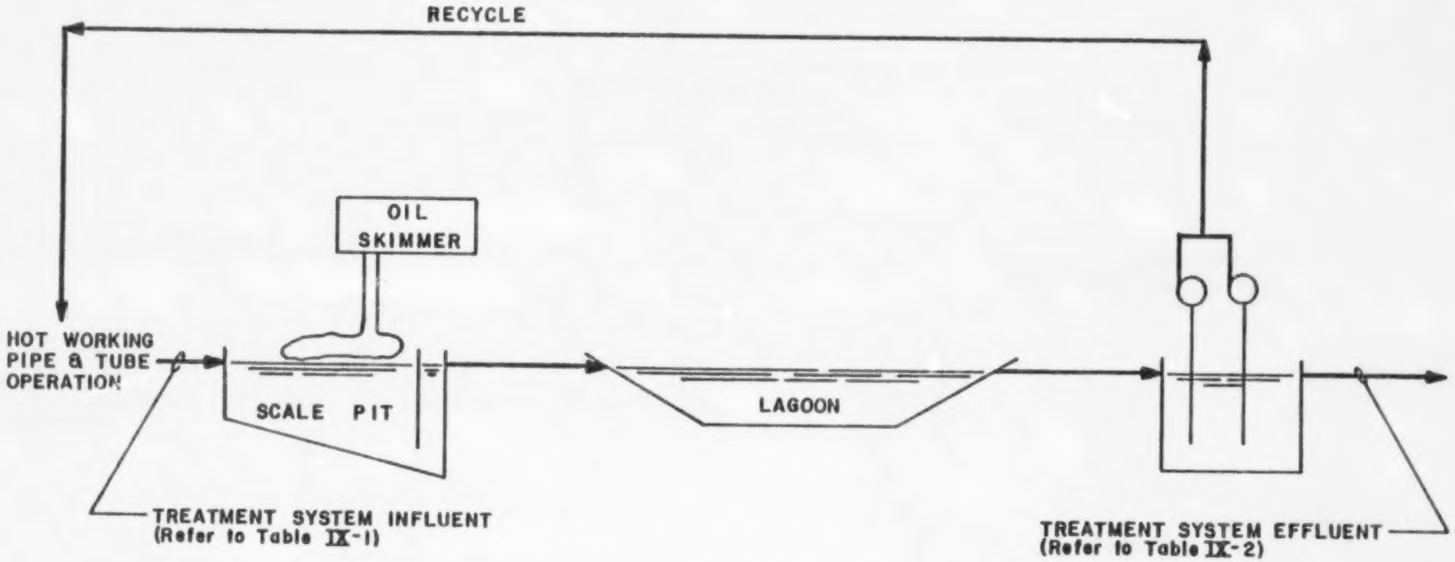
RECYCLE
OIL SKIMMER
HOT WORKING PIPE AND TUBE OPERATION
SCALE PIT
CLARIFIER
FILTER
TREATMENT SYSTEM INFLUENT (REFER TO TABLE IX-1)
TREATMENT SYSTEM EFFLUENT (REFER TO TABLE IX-2)
VACUUM FILTER
SOLIDS TO DISPOSAL

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
PIPE AND TUBE - INTEGRATED
BPT MODEL

Dwn. 1/22/80

FIGURE IX-2


RECYCLE
OIL SKIMMER
HOT WORKING PIPE & TUBE OPERATION
SCALE PIT
LAGOON
TREATMENT SYSTEM INFLUENT (Refer to Table IX-1)
TREATMENT SYSTEM EFFLUENT (Refer to Table IX-2)

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
PIPE AND TUBE-ISOLATED
BPT MODEL

Dwn. 1/18/80

FIGURE IX-3

HOT FORMING SUBCATEGORY

SECTION X

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF THE BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE

Introduction

The best available technology economically achievable (BAT) effluent limitations are to be achieved by July 1, 1984. Best available technology is determined by identifying the best economically achievable control and treatment technology employed within the subcategory. Also, where a technology is readily transferable from one industry to another, such technology may be identified as BAT. The BAT treatment technologies developed herein reflect the wastewater quality and treatment systems currently in widespread use in the hot forming subcategory.

This section identifies two BAT alternative treatment systems and the resulting effluent levels. In addition, the rationale for selecting the treatment technologies, discharge flow rates and effluent concentrations are presented. In addition, the BAT model treatment system which is selected to serve as the basis for the proposed BAT effluent limitations is described.

Prior to the development of the BAT alternative treatment systems, the Agency reviewed the DCP and D-DCP responses for the hot forming subcategory to determine the treatment practices in use. As a result of this review, the Agency developed three basic treatment systems, to which the BAT alternative treatment systems could be "added on." Following are descriptions of these models:

Model No. 1 - Primary sedimentation is provided in a scale pit equipped with oil skimming facilities. Additional solids removal is accomplished in a clarifier or thickener. The solids removed in the clarifier/thickener are dewatered by vacuum filtration. Fifty percent of the scale pit effluent is recycled in the primary and section mill models, and thirty percent of the scale pit effluent is recycled in the flat mill models. Fifty percent of the clarifier/thickener effluent is recycled in the pipe and tube mill model. The blowdown from the clarifier is further treated in a filtration system.

Model No. 2 - This model follows the same basic treatment as Model No. 1; however, no recycle is provided and the entire flow in each hot forming subcategory is filtered prior to discharge.

Model No. 3 - This model is similar in each subcategory to the first model, with the exception that the process wastewaters are not filtered prior to discharge.

In each of the models, the secondary sedimentation step can involve clarifiers, thickeners, lagoons, and secondary scale pits. Additional details on the treatment model concept were presented in Section VIII.

Identification of BAT

Based upon the information developed in Sections III through VIII the Agency developed the following treatment technologies to attain BAT (formulated as add-ons to the models described above) for the hot forming subcategory.

BAT Alternative No. 1

In Models Nos. 1 and 2 the filter effluents are pumped over evaporative cooling towers. In each case, a sufficient portion of the cooling tower effluent is recycled so that an overall treatment system recycle rate of ninety-six percent can be attained.

In Model No. 3, the clarifier/thickener effluent is pumped to an evaporative cooling tower. A sufficient portion of the cooling tower effluent is recycled in each case so that an overall recycle rate of ninety-six percent can be attained. In this model the cooling tower blowdown is filtered as this model does not include filtration technology in the recycle system loop. As noted in Section VII, the cooling tower is incorporated as a means of reducing recycle system heat loads. The reduction in discharge volume greatly reduces the discharge of toxic and conventional pollutants.

BAT Alternative No. 2

In this alternative the cooling tower blowdowns of Model Nos. 1 and 2 receive additional treatment aimed at further reducing toxic metals. The additional treatment consists of sulfide precipitation followed by filtration. As filtration is already included in the third model of the first BAT alternative, only sulfide precipitation is included in Model No. 3. For this model, the sulfide slurry is added prior to filtration but downstream of the recycle station provided in the first BAT alternative. Figures X-1 and X-2 illustrate the various model and BAT Alternative combinations for the hot forming subcategory. Aside from sulfide precipitation, the treatment technologies shown are widely used throughout the hot forming subcategory.

The effluent limitations associated with the alternative treatment systems are presented in Tables X-1 and X-2. Section VI presented the rationale for the limitation of five toxic metals. However, the Agency has determined that limitations for three of these - chromium, lead, and zinc - will effectively control the five toxic metals present at treatable levels. As noted in Section VI, other toxic metal pollutants may be found in the wastewaters from a particular mill; however, control of the three toxic metals limited at BAT will also provide adequate control for other toxic metal pollutants which may be present at low levels. As noted in Section VI, the high degree of recycle incorporated at the BAT level will also result in removal of those organics detected at low levels in hot forming wastes.

Rationale for Selection of the BAT Alternatives

The following discussion presents the rationale for selecting the BAT model treatment systems, selecting model flow rates, and determining the concentration levels of the pollutants selected for limitation.

Treatment Scheme

After reviewing the various treatment systems in use in the hot forming subcategory (as described in the DCP and D-DCP responses), the Agency developed three basic models upon which the various BAT alternative treatment systems could be applied.

The rates of primary scale pit recycle included in the basic models were developed from data presented in DCPs and D-DCPs responses. This initial recycle is generally provided for flume flushing. This recycle is not included in Model 2. The reported primary scale pit effluent recycle rates for the hot forming subdivisions are summarized in Table X-3. The basic model recycle rates of fifty percent for primary, section, and pipe and tube operations and thirty percent for flat operations are well demonstrated. A key factor in the use of a preliminary recycle is the reduction in the volume of wastewater requiring subsequent treatment, which reduces costs for the subsequent treatment components.

In order to reduce discharge flows, and thus reduce discharged pollutant loads, the Agency considered additional recycle for the BAT alternatives. The overall recycle rate (combining the basic model and BAT recycles) for hot forming operations was established by reviewing recycle rates in each subdivision and then averaging those recycle rates considered to be the best in each case. Those recycle rates greater than ninety percent are considered to be representative of good treatment. Table X-4 presents a summary (from highest to lowest) of the recycle rates observed in the hot forming subcategory. The average of the best recycle rates for each hot forming subdivision follow.

Subdivision	Recycle Rate
Primary	97%
Section	97%
Flat	96%
Pipe and Tube	97%

Based upon these data, the Agency believes that a ninety-six percent recycle rate is achievable across all hot forming subdivisions. The Agency believes that a common recycle rate for all hot forming operations is applicable because many plants have central treatment for wastewaters from two or more hot forming subdivisions.

In order to facilitate the attainment of the recycle rate described above, cooling towers are included as part of each alternative treatment system. Evaporative cooling towers are incorporated in the BAT alternative treatment systems to reduce the increased heat loads that can result with extensive recycle systems. As noted in Section

VII, many hot forming operations employ cooling towers as integral components of recycle systems.

Filtration is included in Model 3 for the first and second BAT alternative treatment systems to bring this model's treatment capabilities up to the levels of the other two basic models. The use of filtration technology was previously substantiated in Sections VII and IX.

Sulfide precipitation in association with filtration is incorporated in BAT Alternative No. 2 for the purpose of reducing the levels of the various toxic metals to 0.10 mg/l or less. Although not employed in this subcategory, this treatment technology has been demonstrated for treatment of wastewaters from other metal finishing processes.

Filtration for the recycle system blowdown is added in conjunction with sulfide precipitation in Models Nos. 1 and 2. If sulfide precipitation were to be incorporated prior to filtration in the basic models, the cost of toxic metals removal would be substantially greater than the proposed BAT treatment scheme due to the much higher flow undergoing treatment in the basic model as opposed to the BAT discharge flow. Since BAT Alternative No. 1 for Model No. 3 incorporates filtration of only the system blowdown, sulfide precipitation from BAT Alternative No. 2 need only be incorporated prior to filtration in this model.

Applied Flows

The Agency determined average applied flows for each hot forming subdivision for the purposes of sizing and costing treatment systems, and establishing effluent limitations. Production weighted flow averages were determined for each hot forming process (Tables X-5 through X-12). All available flow data were used to derive the average flow rates. It should be noted that a separate flow allowance of 1050 GPT was provided for machine scarfing operations at primary mills. Additionally, a 50 GPT flow was added for wet scrubbers used on scarfing units.

Discharge Flows

The discharge flows incorporated in the treatment systems for BAT Alternatives Nos. 1 and 2 are based upon the recycle of ninety-six percent of the applied flow. Depending upon model type, different degrees of recycle will occur at BAT. The BAT feed applied flows, treated recycle rates, and resultant discharge flows for the hot forming subdivisions, by model type, are summarized in Table X-13. It can be seen in this table that plants of the Model 2 configuration must recycle 96% of the flow to the BAT components to achieve the model discharge flow. However, plants of the Model 1 and 3 configurations do not have to recycle the entire 96% at BAT because the plants in these models have recycle steps at BPT. The industry reported achieving high recycle rates without any problems due to plugging or scaling.

Wastewater Quality

The average effluent concentrations levels incorporated in each BAT alternative treatment system (the maximum values are enclosed in parentheses) are as follows.

	BAT Alt. No. 1	BAT Alt. No. 2
Chromium, mg/l	0.10(0.30)	0.10(0.30)
Lead, mg/l	0.10(0.30)	0.10(0.30)
Zinc, mg/l	0.10(0.30)	0.10(0.30)

As noted above, the Agency is proposing BAT limitations for three toxic metals: chromium, lead, and zinc. These three have been chosen because of their ability to serve as indicators for the other toxic metals present in hot forming wastewaters. The development of these concentration values is presented in Volume I.

Effluent Limitations for BAT Alternatives

The effluent limitations for the BAT alternative treatment systems were calculated by multiplying the effluent flows of the alternative treatment system by the effluent concentration of each pollutant and an appropriate conversion factor. Tables X-1 and X-2 present the proposed effluent limitations for each process within each BAT alternative treatment system.

Selection of a BAT Alternative

The Agency selected BAT Alternative No. 1 as the BAT model treatment system upon which the proposed BAT effluent limitations are based. The Agency decided that, at this time, Alternative No. 1 is the most appropriate BAT alternative system because of the significant removal of toxic metals.

The proposed BAT effluent limitations are presented in Table X-1.

TABLE X-1

BAT ALTERNATIVE NO. 1 EFFLUENT LIMITATIONS*

HOT FORMING SUBCATEGORY

		CONCENTRATION BASIS	BAT NO. 1 EFFLUENT LIMITATIONS (lbs/1000 lbs)							
		ALL HOT FORMING OPERATIONS	PRIMARY MILLS		SECTION MILLS		FLAT MILLS			PIPE & TUBE MILLS
			WITHOUT SCARFERS	WITH SCARFERS	CARBON	SPECIALTY	HOT STRIP & SHEET	CARBON PLATE	SPECIALTY PLATE	CARBON & SPECIALTY
DISCHARGE FLOW (gal/ton)			90	140	200	130	260	140	60	220
CHROMIUM	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
LEAD	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
ZINC	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275

*ALTERNATIVE 1 HAS BEEN SELECTED AS THE BAT SYSTEM

TABLE X-2

BAT ALTERNATIVE NO. 2 EFFLUENT LIMITATIONS

HOT FORMING SUBCATEGORY

		CONCENTRATION BASIS	BAT Nº2 EFFLUENT LIMITATIONS (lbs/1000 lbs)							
		ALL HOT FORMING OPERATIONS	PRIMARY MILLS		SECTION MILLS		FLAT MILLS			PIPE & TUBE MILLS
			WITHOUT SCARFERS	WITH SCARFERS	CARBON	SPECIALTY	HOT STRIP & SHEET	CARBON PLATE	SPECIALTY PLATE	CARBON & SPECIALTY
DISCHARGE FLOW (gal/ton)			90	140	200	130	260	140	60	220
CHROMIUM	AVE	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
LEAD	AVE	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
ZINC	AVE	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275

TABLE X-3

ANALYSIS OF RECYCLE RATES
FROM PRIMARY SCALE PITS
HOT FORMING SUBCATEGORY

Subdivision	Plant Code	Recycle Percentage
A. Primary	0946A	9.0*
	0684G	14.7*
	0856F	25.0
	0432C	44.9
	0856N	47.0
	0868A-03	48.8
	0060-01	50.0
	0112A-01	53.0
	0948A	63.5
	0920B	68.0
	0640	70.8
	0112A-03	75.0*
	0864A-01	75.0*
	0724A	79.2*
	0864A-02	85.7*
	0060G-01	86.0*
	0320-02	96.2*
	0940	100.0*
	Average of Unstarred Values = 53.3%	
B. Section	0060G-01	6.3*
	0684G-01	8.8*
	0060H-01	32.0
	0384A-06	33.0
	0684H-05	42.0
	0684H-04	44.4
	0856F-03	50.0
	0856F-02	50.0
	0060F-04	56.5
	0856F-02	66.7
	0060I-02	75.0
	0864A	78.9
	0476A-03	97.2*
	0864B	97.3*
	0460B	99.0*
	0068B	100.0*
	0256N-01	100.0*
	0256N-02	100.0*
	0256N-03	100.0*
	0316A	100.0*
	Average of Unstarred Values = 53.7%(1)	

TABLE X-3
ANALYSIS OF RECYCLE RATES FROM PRIMARY SCALE PITS
HOT FORMING SUBCATEGORY
PAGE 2

Subdivision	Plant Code	Recycle Percentage
C. Flat	0060	4.0*
	0860B-01	11.1
	0432C	11.5
	0684F-02	18.9
	0856F	22.9
	0384A-02	27.6
	0320-02	32.3
	0920C	33.7
	0920N	40.8
	0856F-02	66.7
	0112A-03	71.4*
	0112A-04	89.6*
	Average of Unstarred Values =	29.5%
D. Pipe & Tube	0856F(01 & 02)	50.0
	0476A	78.7
	0548	80.0
	0856C	99.4
	Average of Unstarred Values =	77.0%

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(1) Average includes some confidential values

*: To determine a typical untreated process water recycle rate, both high and low values were omitted so that a more realistic median value could be approached.

TABLE X-4

ANALYSIS OF OVERALL RECYCLE RATES
HOT FORMING SUBCATEGORY

Subdivision	Plant Code	Recycle Rates RUP	RTP	Total
A. Primary	0940	100.0	0	100.0
	0060I	0	100.0	100.0
	0440A	0	100.0	100.0
	0684H	0	99.7	99.7
	0088D	99.0	0	99.0
	0248B	0	98.8	98.8
	0060D	0	98.4	98.4
	0612 (01 & 02)	0	98.0	98.0
	0432J	90.0	7.5	97.5
	0860A (01-03)	0	96.5	96.5
	0320-02	96.2	0	96.2
	0248C	0	93.3	93.3
	0176	0	93.0	93.0
	0864C	0	92.7	92.7
	0432C	44.9	47.4	92.3
	0248A	0	90.3	90.3
	0060	50.0	39.6	89.6
	0476A	0	88.3	88.3
	0920N	0	88.2	88.2
	0496	87.5	0	87.5
	0920A	0	86.2	86.2
	0060G	86.0	0	86.0
	0684A-02	85.7	0	85.7
	0424	0	80.0	80.0
	0672B	80.0	0	80.0
	0724A	79.2	0	79.2
	0864A-01	75.0	0	75.0
	0112A-03	75.0	0	75.0
	0640	70.8	0	70.8
	0920B	68.0	0	68.0
	0948A	63.5	0	63.5
	0112A-01	53.0	0	53.0
	0396E	0	53.0	53.0
	0868A-03	48.8	2.6	51.4
	0188B	0	49.5	49.5
	0684I	0	47.0	47.0
	0856N	47.0	0	47.0
	0460A	0	37.3	37.3
	0946A	9.0	26.0	35.0
	0112B-03	0	34.5	34.5
	0856F	25.0	0	25.0
	0684G	14.7	0	14.7
	0868A-02	0	2.4	2.4

Average of All Values = 74.4%
Average of Values $\geq$90% = 96.6%

TABLE X-4
ANALYSIS OF OVERALL RECYCLE RATES
HOT FORMING SUBCATEGORY
PAGE 2

	Plant	Recycle Rates		
Subdivision	Code	RUP	RTP	Total
B. Section	0060I-01	75.0	25.0	100.0
	0060I-02	0	100.0	100.0
	0256N	100.0	0	100.0
	0316A	100.0	0	100.0
	0316B	0	100.0	100.0
	0460A (01 & 02)	0	100.0	100.0
	0672B (01 & 02)	0	100.0	100.0
	0684H (01-03)	0	99.7	99.7
	0684H-05	42.0	57.7	99.7
	0060K-01	0	99.6	99.6
	0060F-05	56.5	43.0	99.5
	0136B-02	0	99.5	99.5
	0860F-03	0	99.5	99.5
	0088D	0	99.2	99.2
	0460B	99.0	0	99.0
	0468B	0	98.9	98.9
	0136B-01	0	98.8	98.8
	0188C	0	98.1	98.1
	0612 (01-04)	0	98.0	98.0
	0188B	0	98.0	98.0
	0384A-06	33.0	64.6	97.6
	0864B	97.3	0	97.3
	0476A-03	97.2	0	97.2
	0640A (01 & 02)	0	97.0	97.0
	0612-05	0	96.8	96.8
	0176 (01-04)	0	96.4	96.4
	0060H-01	32.0	64.0	96.0
	0860H (01 & 02)	0	96.0	96.0
	0946A-03	0	95.8	95.8
	0136C	0	95.1	95.1
	0684H-04	0	94.9	94.9
	0864C (01 & 02)	0	92.7	92.7
	0864A	78.9	12.3	91.3
	0804B-01	0	90.7	90.7
	0860F (01 & 02)	0	90.0	90.0
	0672A (01 & 02)	0	89.6	89.6
	0112-07	0	89.0	89.0
	0476A-02	0	88.8	88.8
	0868A (03-05)	0	86.4	86.4
	0112A-01	0	83.3	83.3
	0946A (01 & 02)	0	82.0	82.0
	0856F-01	66.7	0	66.7
	0468F	0	66.6	66.6
	0920B-01	0	59.4	59.4
	0684E (01 & 02)	0	53.3	53.3

TABLE X-4
ANALYSIS OF OVERALL RECYCLE RATES
HOT FORMING SUBCATEGORY
PAGE 3

Subdivision	Plant Code	Recycle Rates		
		RUP	RTP	Total
B. Section (Cont.)	0856F (02 & 03)	50.0	0	50.0
	0856F-04	44.4	0	44.4
	0316	0	37.0	37.0
	0476A-01	0	33.8	33.8
	0424-01	0	17.0	17.0
	0424 (02 & 03)	0	9.0	9.0
	0060G-01	6.3	0	6.3
		Average of All Values = 84.6%		
		Average of Values ≥90% = 97.5%		
C. Flat	0248B	0	98.8	98.8
	0060	4.0	94.0	98.0
	0684F-02	18.9	78.7	97.6
	0860H-02	0	97.2	97.2
	0860H-01	0	96.3	96.3
	0868B	0	96.3	96.3
	0176	0	92.8	92.8
	0112-04	89.6	0	89.6
	0868A-03	0	88.5	88.5
	0868A-02	13.6	77.9	88.5
	0868A-01	0	88.5	88.5
	0684B	0	84.5	84.5
	0432C	11.5	69.8	81.3
	0112A-03	71.4	0	71.4
	0856F-02	66.7	0	66.7
	0476A	0	59.8	59.8
	0684I-02	0	53.0	53.0
	0684I-01	0	47.0	47.0
	0920N	40.8	0	40.8
	0920C	33.7	0	33.7
	0320-02	32.3	0	32.3
	0856F-01	22.9	0	22.9
	0860B-01	11.1	0	11.1
		Average of All Values = 71.2%		
		Average of Values ≥90% = 96.7%		
D. Pipe & Tube	0060R (01 & 02)	0	100.0	100.0
	0856C	99.4	0	99.4
	0684A	0	97.0	97.0
	0728	0	96.8	96.8
	0396E	0	91.0	91.0
	0240B-05	0	87.5	87.5

TABLE X-4
ANALYSIS OF OVERALL RECYCLE RATES
HOT FORMING SUBCATEGORY
PAGE 4

Subdivision	Plant Code	Recycle Rates RUP	Recycle Rates RTP	Recycle Rates Total
D. Pipe & Tube (Cont.)	0796B	0	82.4	82.4
	0548	80.0	0	80.0
	0476A	78.7	0	78.7
	0548A-01	0	77.6	77.6
	0196A	0	64.3	64.3
	0088C-01	0	61.4	61.4
	0548A-02	0	50.0	50.0
	0856F (01 & 02)	50.0	0	50.0
	0796A-02	0	41.6	41.6
	0492A-05	0	18.9	18.9

Average of All Values = 73.5%
Average of Values $\geq$90% = 96.8%

KEY TO CODES

RUP: Recycle process water from primary scale pit.
RTP: Recycle treated process water.

TABLE X-5

BAT APPLIED FLOW DETERMINATION
HOT FORMING-PRIMARY: CARBON & SPECIALTY

Basic Flow, Excluding Machine Scarfing

Plant Reference Code	Applied Flow (Gal/Ton)	Production Capacity (Tons/Day)	Total Applied Flow (MGD)
0020B	1594	4065	6.48
0060	1012	8537	8.64
0060D	254	2268	0.58
0060G	3891	2868	11.16
0060I	3782	495	1.87
0176	1011	285	0.29
0188A	5585	825	4.61
0188B	3656	804	2.94
0248C	2186	415	0.91
0320-02	805	9600	7.73
0384A-01	7483	3864	28.91
0396E	4465	1419	6.34
0424	800	450	0.36
0430C-01	288	90	0.026
0430C-02	1655	114	0.19
0440A	27,163	387	10.51
0476A	3273	1699	5.56
0492A	1551	3714	5.76
0528A	1090	5550	6.05
0612-01	3913	3312	12.96
0612-02	4926	2631	12.96
0640	4332	1878	8.14
0652A	1087	795	0.86
0672B	6517	453	2.95
0684A	742	4851	3.60
0684B	734	4905	3.60
0684E	857	2520	2.16
0684F-01	3698	1752	6.48
0684H	954	5565	5.31
0856H-01	2725	1872	5.10
0856H-02	2787	1830	5.10
0856T-01	1281	4059	5.20
0860B-04	3587	2529	9.07
0860H-01	6747	2988	20.16
0860H-02	1866	8490	15.84
0860H-03	5859	3441	20.16
0864A-01	1272	6795	8.64
0864A-02	2124	2373	5.04
0864C	1280	450	0.58
0868A-01	1236	3000	3.71

TABLE X-5
BAT APPLIED FLOW DETERMINATION
HOT FORMING-PRIMARY: CARBON & SPECIALTY
PAGE 2

Plant Reference Code	Applied Flow (Gal/Ton)	Production Capacity (Tons/Day)	Total Applied Flow (MGD)
0868A-02	614	2340	1.44
0868A-03	1886	4692	8.85
0920A	3100	5361	16.62
0920B	2382	5325	12.68
0940	1067	135	0.14
0946A	1296	3066	3.97
0948A	1105	3909	4.32
0948B	1095	3930	7.49
0948C-01	710	4461	3.17
0948C-02	3308	7923	26.21

$$\text{Production Weighted Applied Flow Average*} = \frac{\Sigma\ \text{Total Applied Flow (MGD)**}}{\Sigma\ \text{Production Capacity (TPD)**}} = \frac{369{,}246{,}000\ \text{GPD}}{162{,}242\ \text{TPD}}$$

$$= 2276\ \text{Gal/Ton}$$

Use: 2300 Gal/Ton

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* : Based on available data. Those operations with unknown flows or with flows which included scarfing or noncontact cooling water are not included.

**: These totals include flow and production data for plants requesting confidential treatment of their individual data.

TABLE X-6

BAT APPLIED FLOW DETERMINATION
HOT FORMING-PRIMARY: CARBON & SPECIALTY
MACHINE SCARFING OPERATIONS

Plant Reference Code	Applied Flow (Gal/Ton)	Production Capacity (Tons/Day)	Total Applied Flow (MGD)
0060	1012	8537	8.64
0060G	1004	2868	2.88
0320-02	1370	9600	13.15
0528A	1038	5550	5.76
0684F-01	2466	1752	4.32
0684H	857	5565	4.77
0920A	365	5361	1.96
0946A	254	3066	0.78
0948H	2376	3909	9.29
0948C-02	600	7923	4.75

$$\text{Production Weighted Applied Flow Average*} = \frac{\Sigma \text{ Total Applied Flow (MGD)}}{\Sigma \text{ Production Capacity (TPD)}} = \frac{56{,}300{,}000 \text{ Gal/Day}}{54{,}131 \text{ Ton/Day}}$$

$$= 1040 \text{ Gal/Ton}$$

Use: 1050 Gal/Ton**

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* : Based on available data. Those operations with unspecified or nonsegregated scarfer flow data are not included in this computation.

**: An additional applied flow of 50 gal/ton is provided to account for blowdowns from scarfer fume scrubbers. Total applied flow from scarfing operations is 1100 gal/ton.

TABLE X-7

BAT APPLIED FLOW DETERMINATION
HOT FORMING-SECTION: CARBON MILLS

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0060F-05	11,576	1,224	14.17
0060H-01	3,025	1,071	3.24
0060K-01	8,045	537	4.32
0068B	20,386	353	7.20
0112A-01	4,627	3,735	17.28
0136B-01	8,372	522	4.37
0136B-02	22,942	354	8.12
0136C	11,859	411	4.87
0188B	7,258	804	5.84
0188C	7,480	462	3.46
0288A-05	1,995	21	0.042
0288A-06	7,014	4	0.028
0288A-07	316	334	0.11
0288A-08	1,328	37	0.049
0316	9,044	446	4.03
0316A	7,543	420	3.17
0316B	10,383	423	4.39
0384A-02	3,055	3,420	10.45
0384A-03	3,797	1,479	5.62
0384A-04	3,860	933	3.60
0384A-05	8,029	816	6.55
0384A-06	3,376	1,758	5.94
0432A-02	6,340	1,167	7.39
0460A-01	4,816	897	4.32
0460A-02	7,744	702	5.44
0460B	32,686	441	14.41
0468B	7,811	1,294	10.10
0468F	29,465	312	9.19
0476A-01	16,719	190	3.18
0476A-02	9,018	502	4.53
0476A-03	10,075	800	8.06
0584F	14,900	807	12.02
0612-01	4,204	3,162	13.29
0612-02	9,870	1,386	13.68
0612-03	12,527	1,092	13.68

TABLE X-7
BAT APPLIED FLOW DETERMINATION
HOT FORMING-SECTION: CARBON MILLS
PAGE 2

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0612-04	4,204	948	3.99
0612-05	5,462	1,239	6.77
0640	3,352	903	3.03
0640A-01	11,449	203	2.32
0640A-02	13,775	507	6.98
0652A-01	7,111	243	1.73
0652A-02	6,261	345	2.16
0672A-01	5,418	817	4.43
0672A-02	10,967	328	3.60
0684A-01	1,705	2,112	3.60
0684A-02	10,052	573	5.76
0684F-01	3,767	1,338	5.04
0684F-02	8,282	765	6.34
0684F-03	8,190	756	6.19
0684G-01	2,240	900	2.02
0684G-02	4,774	1,131	5.40
0684G-03	5,026	573	2.88
0684G-04	9,722	237	2.30
0684H-01	4,710	2,898	13.65
0684H-03	930	2,898	2.70
0684H-04	3,792	1,314	4.98
0684H-05	4,800	1,707	8.19
0684H-06	3,933	996	3.92
0684H-07	9,067	432	3.92
0804B-01	138	150	0.021
0804B-02	131	342	0.045
0856F-01	1,258	6,867	8.64
0856F-02	952	6,867	6.54
0856F-04	12,238	1,057	12.94
0856F-05	8,101	2,133	17.28
0856H-01	1,515	1,683	2.55
0856H-02	1,906	1,338	2.55
0856K-01	61	123	0.0075
0856K-02	198	255	0.050
0856K-03	1,770	732	1.30

TABLE X-7
BAT APPLIED FLOW DETERMINATION
HOT FORMING-SECTION: CARBON MILLS
PAGE 3

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0856N-01	3,226	3,348	10.80
0856N-02	6,272	1,722	10.80
0856P	5,656	1,233	6.97
0856T-01	535	1,029	0.55
0856U-01	14,894	204	3.04
0856U-02	6,699	690	4.62
0856U-03	5,638	378	2.13
0856U-04	12,288	225	2.76
0856U-05	8,125	693	5.63
0860B-01	3,309	2,132	7.05
0860B-02	5,909	536	3.17
0860B-03	6,522	486	3.17
0860B-04	2,663	1,135	3.02
0860B-05	9,399	429	4.03
0860B-08	11,993	492	5.90
0860B-09	7,590	474	3.60
0860B-10	12,751	892	11.37
0860B-11	6,880	1,464	10.07
0860F-01	7,934	726	5.76
0860F-02	4,936	1,167	5.76
0860H-01	7,796	2,616	20.39
0860H-02	4,690	1,380	6.47
0860H-03	6,930	2,058	14.26
0864A	10,729	2,040	21.89
0864B	9,054	1,161	10.51
0864C-01	3,840	450	1.73
0864C-02	10,000	360	3.60
0868A-01	1,020	1,902	1.94
0868A-02	709	2,307	1.64
0868A-03	1,647	1,386	2.28
0868A-04	3,909	249	0.97
0868A-05	963	537	0.52
0920B-01	1,037	1,806	1.87
0920B-02	1,674	516	0.86

TABLE X-7
BAT APPLIED FLOW DETERMINATION
HOT FORMING-SECTION: CARBON MILLS
PAGE 4

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0946A-01	7,589	759	5.76
0946A-03	7,798	831	6.48
0948B	2,625	768	2.02
0948F-03	3,750	29	0.11

$$\text{Production Weighted Applied Flow Average*} = \frac{\Sigma\ \text{Total Applied Flow**}}{\Sigma\ \text{Production Capacity**}} = \frac{661{,}980{,}000\ \text{gal/day}}{130{,}892\ \text{tons/day}}$$

$$= 5058\ \text{gal/ton}$$

Use: 5100 gal/ton

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* : Based on available data. Those operations with unknown or not available data are not included in the data base.

**: This total includes flow and production data for confidential operations.

TABLE X-8

BAT APPLIED FLOW DETERMINATION
HOT FORMING SECTION-SPECIALTY MILLS

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0060I-01	10,636	176	1.87
0060I-02	13,040	138	1.80
0088A	561	531	0.30
0088D	9,836	885	8.70
0112-07	33,391	138	4.61
0176-01	6,190	30	0.19
0176-02	34,285	11	0.38
0176-03	4,911	78	0.38
0176-04	8,228	210	1.73
0288A-01	4,114	7	0.029
0288A-02	2,527	14	0.035
0288A-03	2,359	22	0.052
0288A-04	3,136	11	0.034
0384A-01	3,055	2,418	7.39
0384A-07	3,276	879	2.88
0424-01	7,283	44	0.32
0424-02	11,707	25	0.29
0424-03	10,537	25	0.26
0440A	3,200	45	0.14
0672B-01	4,880	270	1.32
0672B-02	5,922	462	2.74
0684D-01	1,493	1,929	2.88
0684D-02	1,689	1,626	2.75
0684E-01	3,087	1,185	3.66
0684E-02	8,571	504	4.32
0684H-02	580	2,280	1.32
0776H-01	2,347	37	0.087
0946A-02	8,742	906	7.92

$$\text{Production Weighted Applied Flow Average}^{*} = \frac{\Sigma\ \text{Total Applied Flow}^{**}}{\Sigma\ \text{Production Capacity}} = \frac{64{,}910{,}000\ \text{gal/day}}{20{,}563\ \text{tons/day}} = \frac{3157\ \text{gal/ton}}{\text{use 3200 gal/ton}}$$

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* : Based on available data. Those operations with unknown or not available data are not included in the data base.

**: This total includes flow and production data for confidential operations.

TABLE X-9

BAT APPLIED FLOW JUSTIFICATION
HOT FORMING-FLAT: HOT STRIP AND SHEET

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0020B	5,421	2,550	13.82
0060	8,297	10,032	83.24
0060D	7,143	2,520	18.00
0112A(03)	4,911	6,978	34.27
0112A(04)	5,619	7,893	44.35
0112D	5,719	12,744	72.88
0176	9,630	240	2.31
0248B	7,680	1,500	11.52
0320(02)	9,951	8,232	81.92
0384A(02)	10,193	12,291	125.28
0384A(03)	17,511	3,666	64.20
0384A(04)	8,573	5,400	46.29
0396D(01)	24,935	231	5.76
0396D(02)	7,033	1,638	11.52
0424(02)	716	20.1	0.01
0432C	4,429	10,404	46.08
0476A	6,282	828	5.20
0492A	3,471	3,152	10.94
0528A	4,686	5,549	26.00
0584B	5,370	14,022	75.30
0584C	3,680	9,375	34.50
0584F	4,014	8,322	33.40
0684B	4,503	6,396	28.80
0684F(02)	9,347	8,223	76.86
0684I(01)	5,802	3,429	19.90
0684V(02)	8,803	20.7	0.18
0776H(02)	6,400	18	0.12
0856D	4,450	8,445	37.58
0856F(01)	5,497	9,168	50.40
0856F(02)	2,840	3,042	8.64
0856P	5,125	253	1.30
0856U(01)	11,277	558	6.29

TABLE X-9
BAT APPLIED FLOW JUSTIFICATION
HOT FORMING-FLAT: HOT STRIP AND SHEET
PAGE 2

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0856U(02)	22,944	150	3.44
0856U(03)	6,400	639	4.09
0856U(04)	4,847	915	4.44
0856U(05)	11,809	2,907	34.33
0860B(01)	8,448	12,204	103.10
0860B(02)	5,594	5,895	32.98
0864A	4,666	6,018	28.08
0868A(02)	21,356	177	3.78
0868A(03)	2,905	4,854	14.10
0920C	7,767	3,300	25.63
0920N	3,198	7,992	26.56
0948A	6,076	7,584	46.08
0948C	6,602	8,724	57.60

$$\text{Production Weighted Applied Flow Average*} = \frac{\text{TOTAL APPLIED FLOW**}}{\text{TOTAL PRODUCTION CAPACITY**}}$$

$$= \frac{1{,}460{,}070{,}000 \text{ gal/day}}{228{,}498.8 \text{ tons/day}} = 6390 \text{ gal/ton}$$

Say 6,400 gal/ton

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* : Based on available data. Those operations with unknown or not available data are not included in the data base.

**: These totals do not include the data from the one plant claiming confidentiality.

TABLE X-10

BAT APPLIED FLOW JUSTIFICATION
HOT FORMING-FLAT: PLATE (CARBON)

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0060F(01)	3,976	2,115	8.41
0112A(01)	2,455	1,056	2.59
0112A(02)	2,778	2,592	7.20
0112D(01)	3,221	3,360	10.82
0384A(01)	7,867	972	7.65
0496(140")	118	1,830	0.22
0496(140"/206")	206	6,300	1.30
0496(112"/120')	869	1,740	1.51
0684I(02)	7,558	1,629	12.31
0856H(01)	117	984	0.12
0856H(02)	5,473	3,939	21.56
0856H(03)	3,652	2,916	10.65
0860B(03)	2,550	3,162	8.06
0860H(01)	9,821	648	6.36
0860H(02)	5,489	2,886	15.84
0868A(01)	3,922	1,800	7.06
0868B	4,992	3,894	19.44

$$\text{Production Weighted Applied Flow Average*} = \frac{\text{TOTAL APPLIED FLOW}}{\text{TOTAL PRODUCTION CAPACITY}}$$

$$= \frac{141{,}100{,}000 \text{ gal/day}}{41{,}823} = 3374 \text{ gal/ton}$$

Say - 3400 gal/ton

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*: Based on available data. Those operations with unknown or not available data are not included in the data base.

TABLE X-11

BAT APPLIED FLOW JUSTIFICATION
HOT FORMING-FLAT: PLATE (SPECIALTY)

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0424(01)	800	450	0.36
0496(140")	144	1,830	0.26
0496(112"/120")	2,653	1,740	4.62
0684V(01)	8,803	119.4	1.05
0776H(01)	960	60	0.06

$$\text{Production Weighted Applied Flow Average} = \frac{\text{TOTAL APPLIED FLOW*}}{\text{TOTAL PRODUCTION CAPACITY*}}$$

$$= \frac{6{,}000 \text{ gal/day}}{4199.4 \text{ tons/day}} = 1512 \text{ gal/ton}$$

Say - 1500 gal/ton

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*: These totals do not include the data from the one plant claiming confidentiality.

TABLE X-12

BAT APPLIED FLOW JUSTIFICATION HOT WORKING PIPE AND TUBE

Plant Reference Code	Applied Flow (gal/ton)	Production Capacity (tons/day)	Total Applied Flow (MGD)
0088A-03	2,712	171	0.46
0088C-01	3,552	283.8	1.01
0088C-02	6,436	268.5	1.73
0196A	12,794	822	10.52
0240B-05	1,858	213	0.40
0256G	515	564	0.29
0396E	450	480	0.22
0432A-01	8,084	699	5.65
0476A	4,672	381.6	1.78
0492A-05	10,154	156	1.58
0548	4,573	196.8	0.90
0548A-01	8,000	126	1.01
0548A-02	6,857	42	0.29
0652A	3,672	363	1.33
0684A-02	4,311	1,002	4.32
0684H	7,013	540	3.79
0728	2,560	240	0.61
0856C	16,000	36	0.58
0856F-01	7,111	663	11.52
0856F-02		957	
0856N-01	3,418	1,011	3.46
0856N-02	3,648	1,500	5.47
0856N-03	3,083	981	3.02
0856N-04	3,730	888	3.31
0916A-01	2,765	600	1.66
0920C-01	4,706	229.5	1.08
0920C-02	5,788	373.2	2.16
0948A-01	6,207	615	8.64
0948A-02		777	
0948A-03	3,077	468	1.44
0948C-01	21,405	444	9.50
0948C-02	6,611	501	3.31

$$\text{Production Weighted Applied Flow Average*} = \frac{\text{TOTAL APPLIED FLOW**}}{\text{TOTAL PRODUCTION CAPACITY**}}$$

$$= \frac{99{,}290{,}000 \text{ gal/day}}{17{,}985 \text{ tons/day}} = 5521 \text{ gal/ton}$$

Say 5,520 gal/ton

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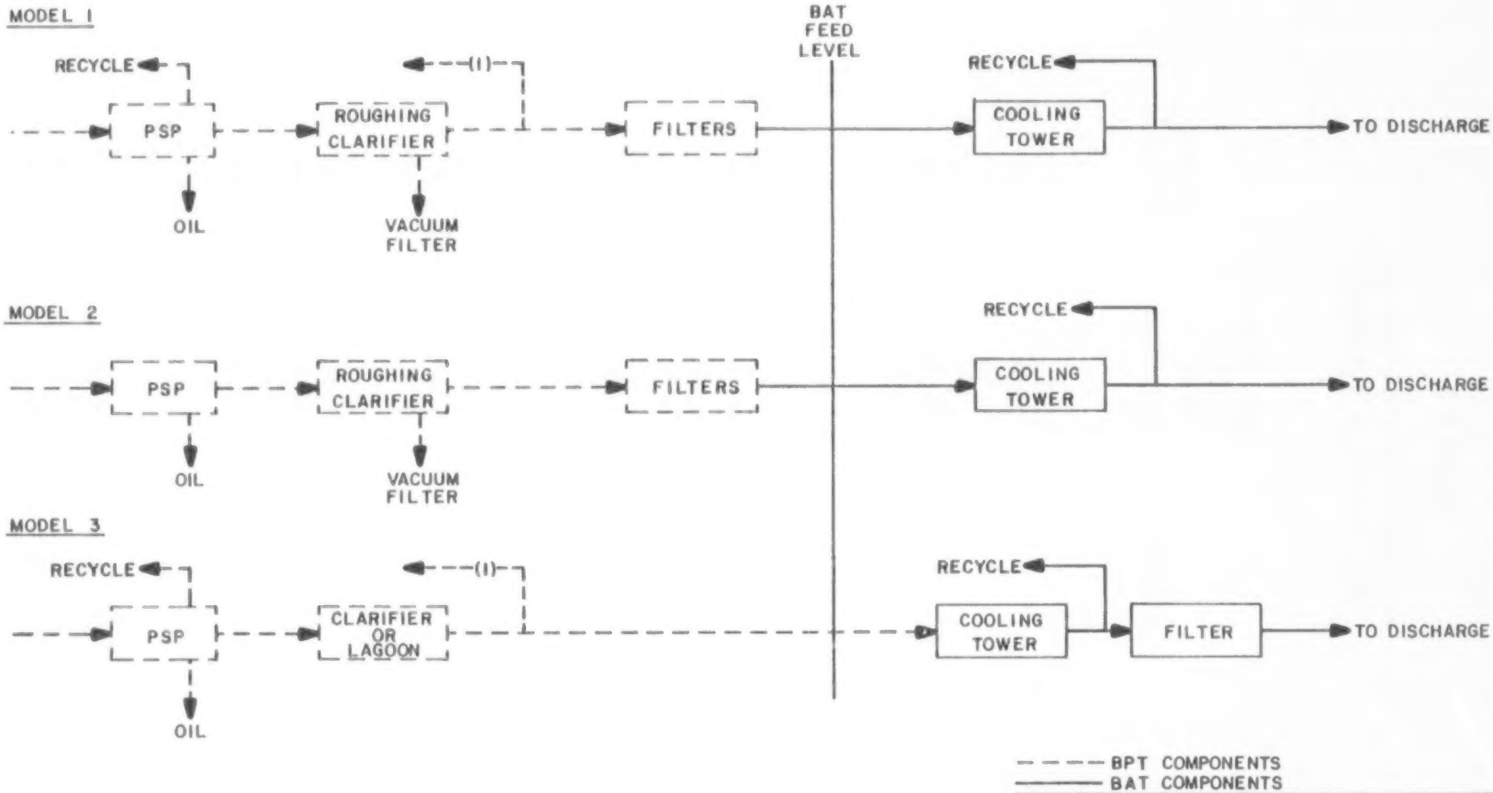
* : Based on available data. Those operations with unknown or not available data are not included in the data base.

**: These totals include the confidential data.

TABLE X-13

BAT FLOW & RECYCLE SUMMARY
HOT FORMING SUBCATEGORY

Subdivision	Model	BAT Feed Applied Flow (gal/ton)	Recycle Rate (%)	BAT Discharge Flow (gal/ton)
PRIMARY				
a. Carbon & Specialty w/o scarfers	1	1150	92	90
	2	2300	96	90
	3	1150	92	90
b. Carbon & Specialty w/scarfers	1	1700	92	140
	2	3400	96	140
	3	1700	92	140
SECTION				
a. Carbon	1	2550	92	200
	2	5100	96	200
	3	2550	92	200
b. Specialty	1	1600	92	130
	2	3200	96	130
	3	1600	92	130
FLAT				
a. Hot Strip & Sheet	1	4480	94	260
	2	6400	96	260
	3	4480	94	260
b. Carbon Plate	1	2380	90	140
	2	3400	96	140
	3	2380	90	140
c. Specialty Plate	1	1050	94	60
	2	1500	96	60
	3	1050	94	60
PIPE & TUBE				
a. Carbon & Specialty	1	2760	92	220
	2	5520	96	220
	3	2760	92	220


MODEL 1
RECYCLE
PSP
OIL
ROUGHING CLARIFIER
VACUUM FILTER
(1)
FILTERS
BAT FEED LEVEL
RECYCLE
COOLING TOWER
TO DISCHARGE
MODEL 2
PSP
OIL
ROUGHING CLARIFIER
VACUUM FILTER
FILTERS
RECYCLE
COOLING TOWER
TO DISCHARGE
MODEL 3
RECYCLE
PSP
OIL
CLARIFIER OR LAGOON
(1)
RECYCLE
COOLING TOWER
FILTER
TO DISCHARGE
BPT COMPONENTS
BAT COMPONENTS

(1) ALTERNATE RECYCLE POSITION FOR HOT WORKING PIPE AND TUBE OPERATIONS

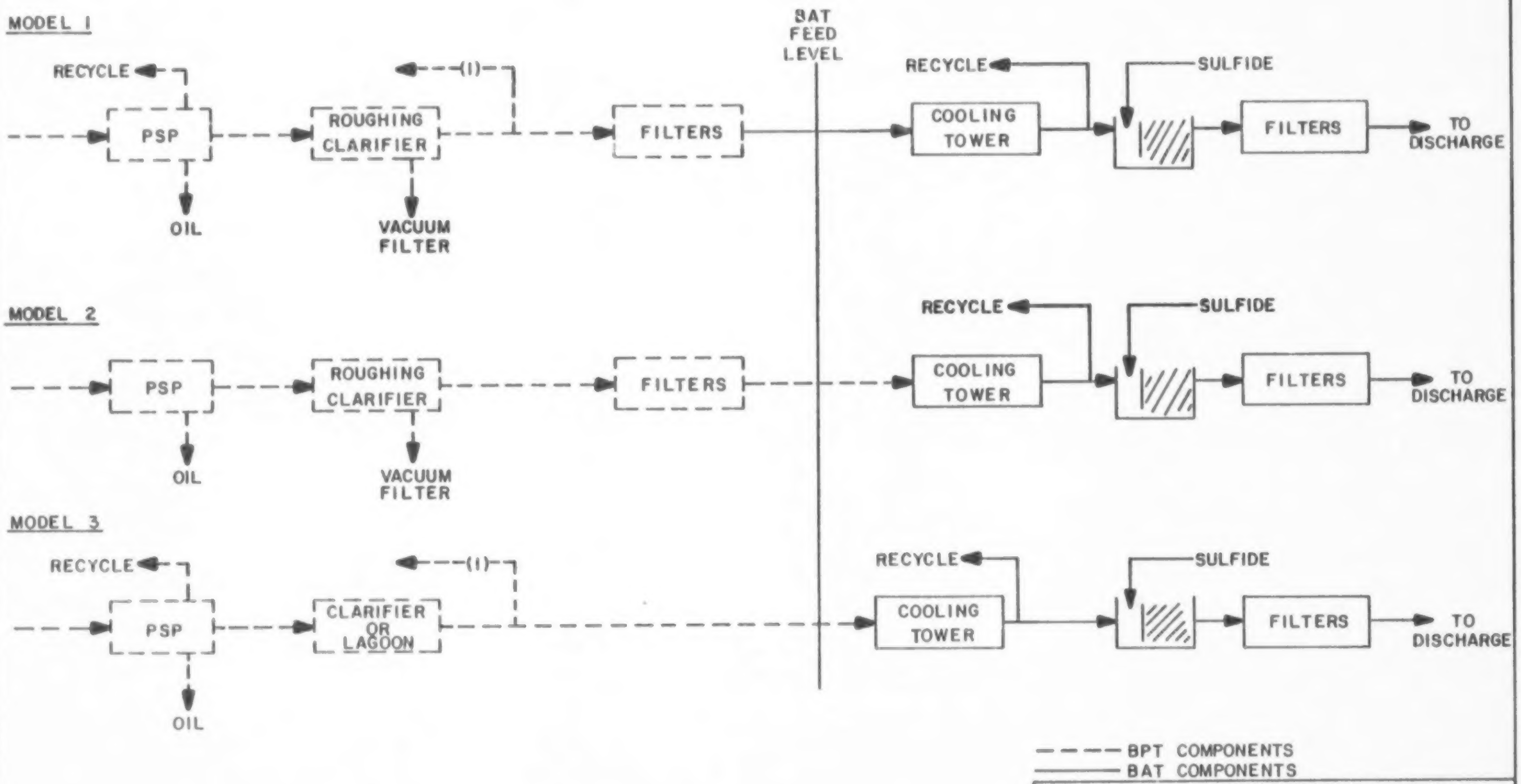
NOTES: FOR ADDITIONAL DETAILS AND RATIONALE FOR THE BAT TREATMENT MODEL CONCEPT SEE THE SECTIONS VIII AND X TEXT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING SUBCATEGORY
BAT MODEL - ALTERNATIVE I

Dwn. 2/14/80

FIGURE X-1


MODEL 1
RECYCLE
PSP
OIL
ROUGHING CLARIFIER
VACUUM FILTER
(1)
FILTERS
BAT FEED LEVEL
RECYCLE
COOLING TOWER
SULFIDE
FILTERS
TO DISCHARGE
MODEL 2
PSP
OIL
ROUGHING CLARIFIER
VACUUM FILTER
FILTERS
RECYCLE
COOLING TOWER
SULFIDE
FILTERS
TO DISCHARGE
MODEL 3
RECYCLE
PSP
OIL
CLARIFIER OR LAGOON
(1)
RECYCLE
COOLING TOWER
SULFIDE
FILTERS
TO DISCHARGE
BPT COMPONENTS
BAT COMPONENTS

(1) ALTERNATE RECYCLE POSITION FOR HOT WORKING PIPE AND TUBE OPERATIONS

NOTES: FOR ADDITIONAL DETAILS AND RATIONALE FOR THE BAT TREATMENT MODEL CONCEPT SEE THE SECTION VIII AND X TEXT

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING SUBCATEGORY
BAT MODEL - ALTERNATIVE 2

Dwn. 2/14/80

FIGURE X-2

HOT FORMING SUBCATEGORY

SECTION XI

BEST CONVENTIONAL POLLUTANT CONTROL TECHNOLOGY (BCT)

Introduction

The 1977 Amendments added Section 301(b)(4)(E) to the Act, establishing "best conventional pollutant control technology" (BCT) for discharges of conventional pollutants from existing industrial point sources. Conventional pollutants are those defined in Section 304(g)(4) - BOD, TSS, fecal coliform and pH - and any additional pollutants defined by the Administrator as "conventional." On July 28, 1978, EPA proposed that COD, oil and grease, and phosphorus be added to the conventional pollutant list (43 Fed. Reg. 32857). Only oil and grease was added.

BCT is not an additional limitation, but replaces BAT for the control of conventional pollutants. BCT requires that limitations for conventional pollutants be assessed in light of a new "cost-reasonableness" test, which involves a comparison of the cost and level of reduction of conventional pollutants from the discharge of POTWs to the cost and level of reduction of such pollutants from a class or category of industrial sources. As part of its review of BAT for certain "secondary" industries, EPA proposed methodology for this cost test. (See 43 Fed. Reg. 37570, August 23, 1978).

Explanation of the BCT Cost Test

The criteria for the BCT Cost Test are contained in Section 304(b)(4)(B) of the Clean Water Act, which requires a consideration of the "cost reasonableness" of effluent limitations for conventional pollutants. The BCT cost comparison is between the cost and level of reduction of the BCT pollutants at a publicly-owned treatment works and the cost and level of reduction of such pollutants in the appropriate iron and steel subcategory (i.e., hot forming).

For the hot forming subcategory, the BCT cost test includes the cost of achieving the proposed BCT limitations from the proposed BPT limitations, and the conventional pollutant load removal from BPT to BCT. The Agency calculated the BCT cost test two ways. It calculated the test based upon both the proposed BPT effluent limitations and the "BAT FEED" effluent quality discussed in Section VIII. Although not required to calculate the BCT test based on "BAT FEED", the Agency did so to see if the results might change; they did not. In all cases, the BCT test was passed.

Development of BCT

The BCT model treatment system is the same as BAT Alternative No. 1 and includes a cooling tower and recycle system for Models 1 and 2, and a cooling tower, recycle system and filter for Model 3.

The BCT test results were detailed previously in Table VIII-48. As shown in that table, the BCT cost test values range from $0.46/lb to $0.94/lb. Systems designed to reduce the proposed BPT discharge to the proposed BCT limitations were developed and then costed so that the cost test could be completed as accurately as possible. The POTW removal cost is $1.34/lb (July 1978 dollars). Therefore, the BCT systems as developed, pass the BCT cost tests and were used to develop the proposed BCT effluent limitations.

Development of Proposed BCT Limitations

Because BCT limitations apply to conventional pollutants, the Agency considered limitations solely for suspended solids, oil and grease, and pH. The proposed BCT effluent limitations for the hot forming subcategory are presented in Table XI-1. The BCT model treatment system is completely compatible with BAT Alternative No. 1 illustrated in Figure X-1.

Reference is made to Appendix A of Volume I for a detailed review of the derivation of the performance standards for TSS and oil and grease. The proposed limitations for pH (6-9) are the same as those proposed for BPT.

BCT Cost Summary

The Agency developed the costs for the BCT model treatment system. These costs are the same as those for BAT Alternative No. 1, and are summarized in Table VIII-48. As shown, the capital and annual costs for all hot forming operations considering facilities in place as of January 1, 1978 are $434.7 million and $110.8 million, respectively.

TABLE XI-1
BCT EFFLUENT LIMITATIONS
HOT FORMING SUBCATEGORY

OPERATION		UNITS	FLOW (GAL/TON)	TOTAL SUSPENDED SOLIDS		OIL & GREASE	
				AVE	MAX	AVE	MAX
PRIMARY MILLS	WITHOUT SCARFERS	#/1000#	—	0.00563	0.0150	—	0.00375
		MG/L	90	15	40	—	10
	WITH SCARFERS	#/1000#	—	0.00878	0.0234	—	0.0136
		MG/L	140	15	40	—	10
SECTION MILLS	CARBON	#/1000#	—	0.0125	0.0334	—	0.00834
		MG/L	200	15	40	—	10
	SPECIALTY	#/1000#	—	0.00813	0.0217	—	0.00542
		MG/L	130	15	40	—	10
FLAT MILLS	HOT STRIP & SHEET	#/1000#	—	0.0163	0.0434	—	0.0108
		MG/L	260	15	40	—	10
	CARBON PLATE	#/1000#	—	0.00878	0.0234	—	0.00584
		MG/L	140	15	40	—	10
	SPECIALTY PLATE	#/1000#	—	0.00375	0.0100	—	0.00250
		MG/L	60	15	40	—	10
PIPE & TUBE MILLS	CARBON & SPECIALTY	#/1000#	—	0.0138	0.0367	—	0.00917
		MG/L	220	15	40	—	10

NOTE: pH IS ALSO REGULATED AT BCT AND IS LIMITED TO 6.0 to 9.0 UNITS.

HOT FORMING SUBCATEGORY

SECTION XII

EFFLUENT QUALITY ATTAINABLE THROUGH THE APPLICATION OF NEW SOURCE PERFORMANCE STANDARDS

Introduction

A new source is defined as any source constructed after proposal of new source performance standards (NSPS). NSPS standards are to consider the degree of effluent reduction achievable through application of best available demonstrated control technology (BADCT), processes, operating methods, or other alternatives, including, where practicable, a standard permitting no discharge of pollutants. Zero discharge, may be a feasible NSPS treatment alternative for the hot forming subcategory and the Agency is soliciting comments on this issue.

Identification of NSPS

NSPS Alternative 1

The first NSPS alternative treatment system includes the BPT model treatment system and the BAT Alternative 1 components discussed in Section IX and X. This system includes sedimentation of the raw wastewater in primary scale pits equipped with oil removal facilities. Both oil and scale removed by this step are reclaimed. A portion of the scale pit effluent is recycled to the process for flume flushing or other uses. In the pipe and tube subcategory this initial recycle occurs after the secondary settling, which directly follows the primary scale pit. After the roughing clarifier, the wastewater is cooled, and recycled to an overall recycle rate of 96%. A four percent blowdown from the cooling tower effluent is filtered and discharged.

NSPS Alternative 2

The NSPS Alternative 2 system is similar to the system described above, except that sulfide precipitation is employed prior to the filtration step. This system is similar to the BPT model treatment system and BAT Alternative 2 system discussed in Sections IX and X.

The NSPS treatment systems described above are depicted in Figures XII-1 and XII-2. The corresponding effluent standards for these systems are presented in Tables XII-1 and XII-2. Cost data for the treatment systems is detailed in Tables VIII-49 through VIII-59.

Rationale for Selection of NSPS

The NSPS alternative treatment systems developed for the hot forming subcategory are similar to the BAT alternative treatment systems described in Sections IX and X. Therefore, the rationale presented in these sections are applicable to NSPS and are not be repeated here.

Treatment Scheme

The NSPS alternative treatment systems include primary scale pits, roughing clarifiers, oil skimming, deep bed pressure filters, cooling towers, recycle and sulfide precipitation. With the exception of sulfide precipitation, all of these technologies are well demonstrated in the hot forming subcategory. As discussed in Section X, sulfide precipitation has been successfully applied to other metals manufacturing process wastewaters and is suitable for steel industry wastewaters as well. The recommended treatment technologies are reliable and demonstrated methods of treatment and are appropriate for NSPS.

The resulting effluent quality for the NSPS alternatives is presented in Tables XII-1 and XII-2. As discussed in Section X, the selected pollutants and the respective effluent concentration values are based upon the capabilities of the various water treatment technologies.

Flows

The applied and discharge flow rates that are used with the NSPS Alternatives for the hot forming subcategory were developed in Section X. The discharge flow within each hot forming subdivision is applicable to both NSPS alternative treatment systems. These flows are demonstrated by plants in the respective subcategories and represent an overall system blowdown rate of 4%. The recycle rate of 96% is also well demonstrated in each of the hot forming subdivisions.

Selection of a NSPS Alternative

The Agency selected NSPS Alternative No. 1 as the NSPS model treatment system upon which the proposed NSPS effluent standards are based. This alternative was selected for the same reasons noted in the discussion in Section X regarding the selection of a BAT model treatment system. The proposed NSPS effluent standards are presented in Table XII-1.

TABLE XII-1

NSPS ALTERNATIVE NO. 1 EFFLUENT STANDARDS *

HOT FORMING SUBCATEGORY

		CONCENTRATION BASIS	NSPS NO. 1 EFFLUENT STANDARDS (lbs/1000 lbs)							
		ALL HOT FORMING OPERATIONS	PRIMARY MILLS		SECTION MILLS		FLAT MILLS			PIPE & TUBE MILLS
			WITHOUT SCARFERS	WITH SCARFERS	CARBON	SPECIALTY	HOT STRIP & SHEET	CARBON PLATE	SPECIALTY PLATE	CARBON & SPECIALTY
DISCHARGE FLOW (gal/ton)			90	140	200	130	260	140	60	220
TOTAL SUSPENDED SOLIDS	AVE.	15	0.00563	0.00878	0.0125	0.00813	0.0163	0.00878	0.00375	0.0138
	MAX.	40	0.0150	0.0234	0.0334	0.0217	0.0434	0.0234	0.0100	0.0367
OIL & GREASE	AVE.	—	STANDARDS WILL BE ON A MAXIMUM BASIS ONLY							
	MAX.	10	0.00375	0.00584	0.00834	0.00542	0.0108	0.00584	0.00250	0.00917
CHROMIUM	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
LEAD	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
ZINC	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275

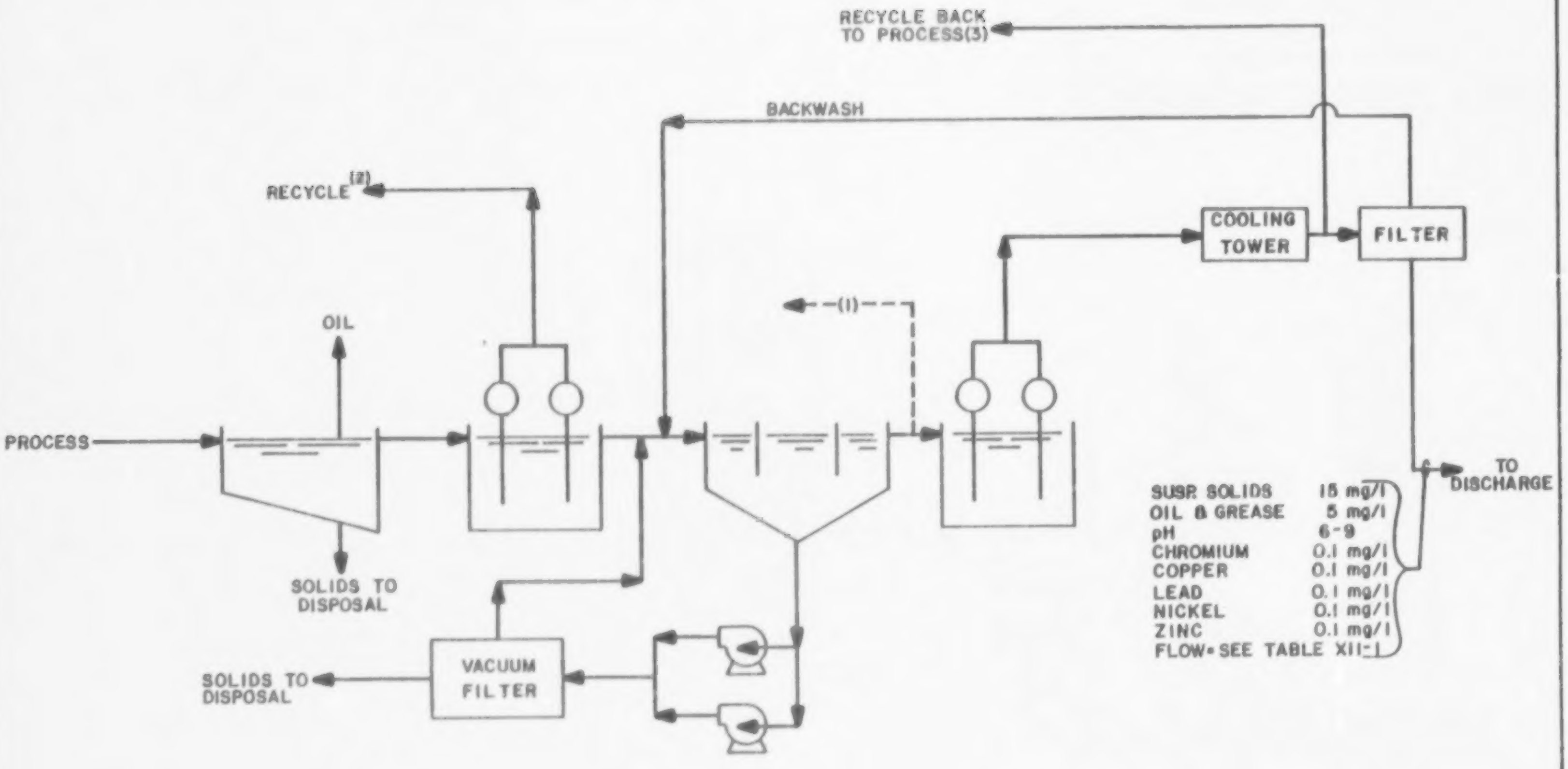
NOTE: pH is also regulated at NSPS and is limited to 6.0 - 9.0 standard units for all hot forming operations.

* Alternative 1 has been selected as the NSPS system

TABLE XII-2
NSPS ALTERNATIVE NO.2 EFFLUENT STANDARDS
HOT FORMING SUBCATEGORY

		CONCENTRATION BASIS	NSPS NO.2 EFFLUENT STANDARDS (lbs/1,000 lbs)							
		ALL HOT FORMING OPERATIONS	PRIMARY MILLS		SECTION MILLS		FLAT MILLS			PIPE & TUBE MILLS
			WITHOUT SCARFERS	WITH SCARFERS	CARBON	SPECIALTY	HOT STRIP & SHEET	CARBON PLATE	SPECIALTY PLATE	CARBON & SPECIALTY
DISCHARGE FLOW(gal/ton)			90	140	200	130	260	140	60	220
TOTAL SUSPENDED SOLIDS	AVE	15	0.00563	0.00878	0.0125	0.00813	0.0163	0.00878	0.00375	0.0138
	MAX	40	0.0150	0.0234	0.0334	0.0217	0.0434	0.0234	0.0100	0.0367
OIL & GREASE	AVE	—	STANDARDS WILL BE ON A MAXIMUM							
	MAX	10	0.00375	0.00584	0.00834	0.00542	0.0108	0.00584	0.00250	0.00917
CHROMIUM	AVE	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
LEAD	AVE	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
ZINC	AVE	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275

NOTE: pH is also regulated at NSPS and is limited to 6.0 - 9.0 standard units for all hot forming operations.


RECYCLE BACK TO PROCESS(3)
BACKWASH
RECYCLE(2)
COOLING TOWER
FILTER
OIL
(1)
PROCESS
TO DISCHARGE
SUSP. SOLIDS 15 mg/l
OIL & GREASE 5 mg/l
pH 6-9
CHROMIUM 0.1 mg/l
COPPER 0.1 mg/l
LEAD 0.1 mg/l
NICKEL 0.1 mg/l
ZINC 0.1 mg/l
FLOW=SEE TABLE XII-1
SOLIDS TO DISPOSAL
VACUUM FILTER
SOLIDS TO DISPOSAL

(1) ALTERNATE RECYCLE LOCATION FOR PIPE & TUBE OPERATIONS

(2) RECYCLE PERCENTAGE
:80% FOR PRIMARY, SECTION, AND PIPE & TUBE OPERATIONS
:30% FOR FLAT OPERATIONS

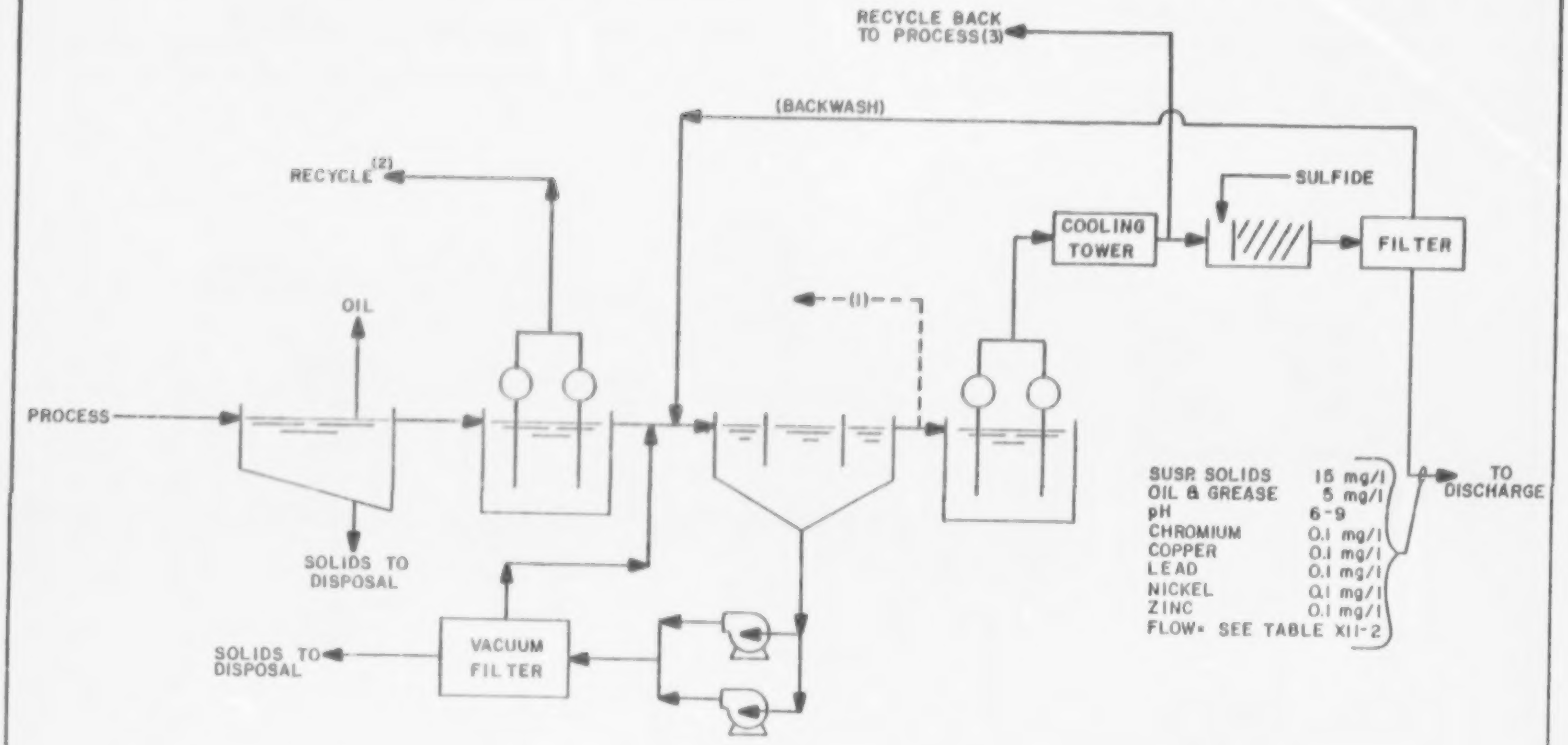
(3) SYSTEM RECYCLE RATE IS INCREASED TO ACHIEVE AN OVERALL RECYCLE RATE OF 96%

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING SUBCATEGORY
NSPS MODEL-ALTERNATIVE I

Dwn.2/15/80

FIGURE XII-1


RECYCLE BACK TO PROCESS(3)
(BACKWASH)
RECYCLE(2)
SULFIDE
COOLING TOWER
FILTER
OIL
(1)
PROCESS
SOLIDS TO DISPOSAL
VACUUM FILTER
SOLIDS TO DISPOSAL
TO DISCHARGE
SUSP. SOLIDS 15 mg/l
OIL & GREASE 5 mg/l
pH 6-9
CHROMIUM 0.1 mg/l
COPPER 0.1 mg/l
LEAD 0.1 mg/l
NICKEL 0.1 mg/l
ZINC 0.1 mg/l
FLOW= SEE TABLE XII-2

(1) ALTERNATE RECYCLE LOCATION FOR PIPE & TUBE OPERATIONS

(2) RECYCLE PERCENTAGE
:50% FOR PRIMARY, SECTION, AND PIPE & TUBE OPERATIONS
:30% FOR FLAT OPERATIONS

(3) SYSTEM RECYCLE RATE IS INCREASED TO ACHIEVE AN OVERALL RECYCLE RATE OF 96%

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING SUBCATEGORY
NSPS MODEL-ALTERNATIVE 2

Dwn.2/15/80

FIGURE XII-2

HOT FORMING SUBCATEGORY

SECTION XIII

PRETREATMENT STANDARDS FOR DISCHARGES TO PUBLICLY OWNED TREATMENT WORKS

Introduction

This section discusses the alternative control and treatment systems available for hot forming operations which discharge wastewaters to publicly owned treatment works (POTWs). Separate consideration has been given to the treatment of hot forming process wastewaters from new sources (PSNS) and from existing sources (PSES). The main factors considered in the development of pretreatment systems were to insure that hot forming wastewaters received sufficient treatment to avoid overloading POTW systems and that toxic pollutants that interfere with, pass through, or are otherwise incompatible with POTW operations are controlled. The general pretreatment and categorical pretreatment standards applying to hot forming operations are discussed below.

General Pretreatment Standards

For detailed information on Pretreatment Standards refer to 43 FR 27736-27773, "General Pretreatment Regulations for Existing and New Sources of Pollution," (June 26, 1978). In particular, 40 CFR Part 403 describes National Standards (prohibited discharges and categorical standards), revisions of categorical standards, and POTW pretreatment programs.

In establishing pretreatment standards for hot forming operations, the Agency gave primary consideration to the objectives and requirements of the General Pretreatment Regulations. In addition, the Agency considered factors specifically applicable to hot forming operations which are discussed below.

The General Pretreatment Regulations set forth general discharge prohibitions that apply to all nondomestic users of a POTW to prevent pass-through of pollutants, interference with the operation of a POTW, and municipal sludge contamination. The regulations also establish administrative mechanisms to ensure application and enforcement of prohibited discharge limits and categorical pretreatment standards. In addition, the regulations contain provisions relating directly to the determination of and reporting on pretreatment standards.

Although wastewaters from about twenty operating hot forming operations are discharged to POTWs, POTWs are usually not designed to treat the toxic pollutants present in hot forming wastewaters. Instead, POTWs are designed to treat biochemical oxygen demand (BOD), suspended solids (TSS), fecal coliform bacteria, and pH. Whatever removal obtained by POTWs for toxic pollutants is incidental to the POTWs main function of treating conventional pollutants. POTWs have historically accepted large amounts of many pollutants well above their capacity to treat them adequately. As the issue of municipal sludge use has become more important, pretreatment standards must address toxic pollutant removal, rather than transfer of these pollutants to POTWs where many pollutants concentrate in the sludges.

Due to the high process flows and the presence of toxic pollutants in wastewaters from hot forming operations, extensive pretreatment must be provided to ensure that these pollutants do not interfere with, pass through, or are otherwise incompatible with POTW operations or cause harm to the treatment plant. The pretreatment wastewater treatment technologies are the same as the BAT treatment levels. The Agency is not proposing pretreatment standards for suspended solids and oil and grease because these pollutants, in the amounts present in the recycled effluents from hot forming operations are compatible with POTW operations. Hot forming wastewaters are compatible with POTW operations and can be effectively treated at POTWs. However, due to the high flow and lack of high organic content in the hot forming wastewaters, these wastes are generally not discharged to POTW operations. Toxic pollutants are reviewed below.

Identification of Pretreatment

The pretreatment systems developed for both New Sources and Existing Sources are identical to the New Source Performance Standard Alternative No. 1 treatment system (refer to Section XII), thus eliminating the need for separate New Source and Existing Source Pretreatment Standards (PSNS and PSES).

The principal goal of the treatment model developed for pretreatment is the control and removal of the toxic metal pollutants. Primary scale pits equipped with oil removal facilities provide for the initial removal of suspended solids, and oil and grease. A portion of the scale pit effluent in all but pipe and tube operations is recycled to the process for the purpose of flume flushing. For primary and section operations, fifty percent of the scale pit effluent is recycled, while thirty-percent of the scale pit effluent is recycled in flat operations. The remaining scale pit effluent is then delivered to roughing clarifiers for the purpose of providing additional suspended solids removal by sedimentation. Fifty percent of the clarifier effluent is recycled in the case of pipe and tube operations. The roughing clarifier underflow is dewatered by vacuum filtration, while the roughing clarifier overflow is delivered to a cooling tower and recycled. Four percent of the cooling tower effluent is blown down. The cooling tower blowdown is filtered prior to discharge to the POTW to reduce toxic metals. The filter backwash is returned to the roughing clarifier inlet. As noted previously, the toxic metals which are present in hot forming wastewaters exist primarily in the suspended particulate matter. Therefore, suspended solids control will achieve removal of toxic metals.

Figure XIII-1 illustrates the pretreatment system described above. The proposed pretreatment effluent standards for the various hot forming operations are presented in Table XIII-1. As mentioned previously, the pretreatment system is identical to the NSPS Alternative No. 1 model and, as a result, reference can be made to the

NSPS model cost data (Tables VIII-49 through VIII-59) for pretreatment cost information.

Rationale for the Selection of Pretreatment Technologies

The recycle rates incorporated in the pretreatment system have been previously justified in Section X. Extensive recycle is needed in hot forming pretreatment systems in order to minimize the hydraulic impact of hot forming operation wastewater discharges to a POTW. Hot forming operations employing little or no recycle can generate volumes of wastewater large enough to, in many instances, either approach or exceed the limits of the POTW tc accept any additional flow. Excessive flows of hot forming wastewaters to a POTW are restricted not only by physical limitations (i.e., hydraulics) but also by process limitations (the "washing out" of the biological treatment media caused by excessive flows). The model discharge flows which were developed by application of supportable recycle rates (Section X) to the applied flows are identical to the BAT and NSPS model discharge flows and are presented in Table XIII-1.

As noted previously, the toxic metals present in hot forming wastewaters exist primarily in the product scale which in turn is represented by the suspended solids. As a result, toxic metals can be initially controlled by removing suspended solids. Recycle and filtration are therefore included in the pretreatment scheme as a means of reducing toxic metals levels and subsequently loads. Pretreatment standards must limit the discharge of toxic metals because high concentrations of the metals can affect the POTW in the following ways: (1) inhibition of the POTW treatment process; (2) pass through POTW treatment; and, (3) contamination of POTW sludges. Reference is made to Section V of Volume I for additional information on those metals and POTW operations.

Various studies[2] have demonstrated that, in particular, two of the toxic metals (lead and zinc) found in hot forming wastewaters inhibit the biological treatment process when found at levels typical of hot forming wastewaters. The filters included in the treatment scheme insure that the adverse impacts of metals in the discharges to POTWs will be minimized.

Other studies[3] involving the electroplating industry (with toxic metals present and at similar levels) indicated that from fifty percent to ninety percent of the toxic metals entering a POTW treatment system will pass through the treatment system. The possibility therefore exists that POTWs could discharge environmentally detrimental levels of toxic metals when accepting various industrial wastewaters. Since domestic wastewaters typically do not contain objectionable amounts of toxic metals, it is necessary for industrial wastewater contributors to control the levels of toxic metals in their discharges to POTWs. In the case of hot forming operations, this would be accomplished through recycle and filtration.

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[2] EPA-430/9-76-017a, Construction Grants Program Information; Federal Guidelines, State and Local Pretreatment Programs.

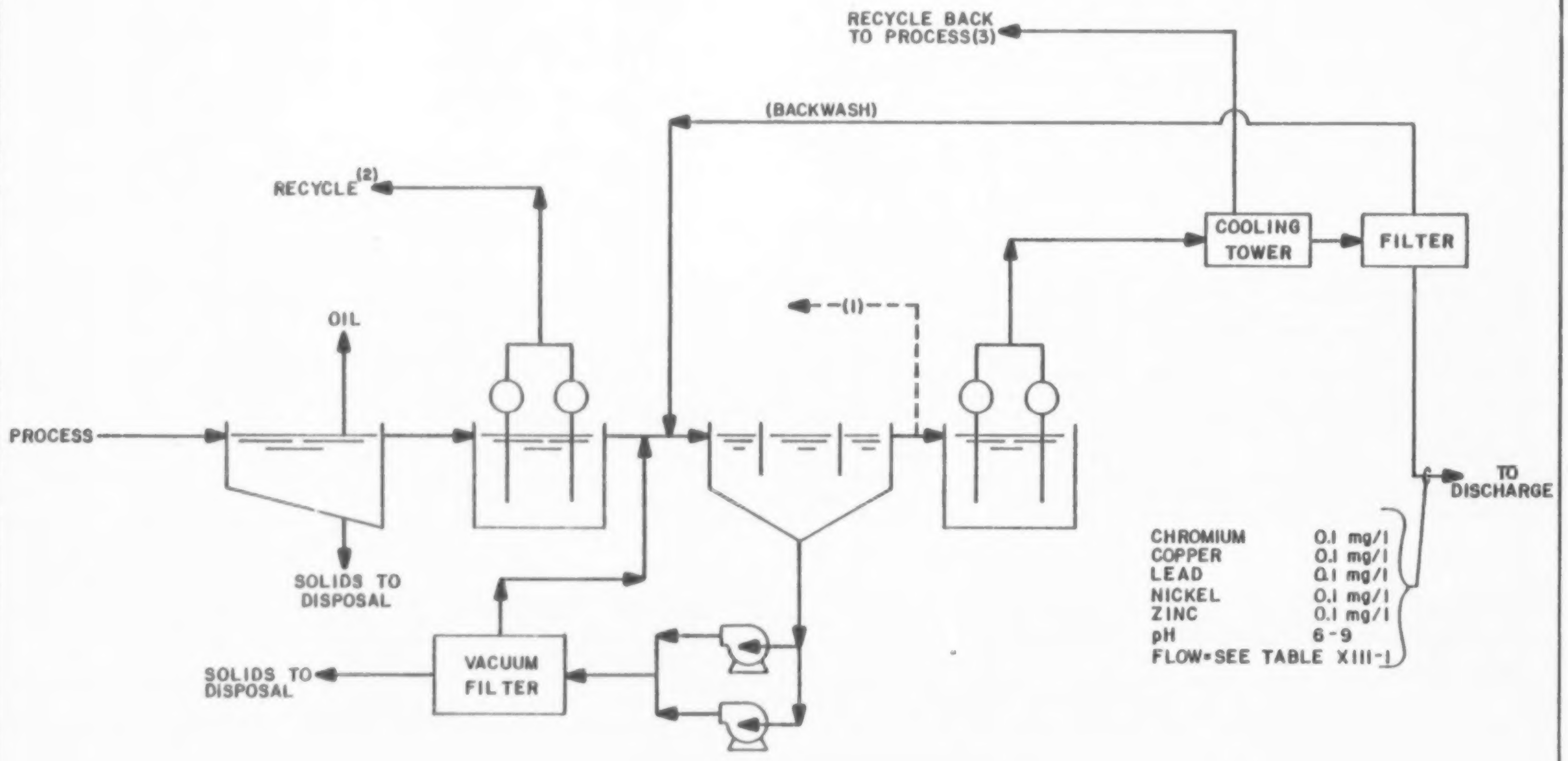
[3] Refer to Federal Register; Friday, September 7, 1979; Part IV, Environmental Protection Agency; Effluent Guidelines and Standards; Electroplating Point Source Category; Pretreatment Standards for Existing Sources - Pages 52597-52601.

The toxic metals which do not pass through a POTW and are not destroyed by the biological treatment and thus concentrate in the POTW sludges. Generally, land application is the least expensive and most advantageous method of POTW sludge disposal. A primary advantage derived from the land application of POTW sludges is the ability of these sludges to provide essential soil nutrients. Excessive amounts of toxic metals in the sludges would, however, inhibit plant growth thus making these sludges unacceptable for use as a fertilizer. Also, these toxic metals could enter either the plant and animal food chain or ground waters, and eventually water supplies. For the above reasons, the control of toxic metals discharges from hot forming operations to POTWs is necessary.

TABLE XIII-1

PRETREATMENT EFFLUENT STANDANDS
HOT FORMING SUBCATEGORY

		CONCENTRATION BASIS	PRETREATMENT STANDARDS (lbs/1000 lbs)							
		ALL HOT FORMING OPERATIONS	PRIMARY MILLS		SECTION MILLS		FLAT MILLS			PIPE & TUBE MILLS
			WITHOUT SCARFERS	WITH SCARFERS	CARBON	SPECIALTY	HOT STRIP & SHEET	CARBON PLATE	SPECIALTY PLATE	CARBON & SPECIALTY
DISCHARGE FLOW (gal/ton)			90	140	200	130	260	140	60	220
CHROMIUM	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
LEAD	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275
ZINC	AVE.	0.10	0.0000375	0.0000584	0.0000834	0.0000542	0.000108	0.0000584	0.0000250	0.0000917
	MAX.	0.30	0.000113	0.000175	0.000250	0.000163	0.000325	0.000175	0.0000751	0.000275


RECYCLE BACK
TO PROCESS(3)
(BACKWASH)
RECYCLE(2)
COOLING TOWER
FILTER
OIL
(1)
PROCESS
TO DISCHARGE
SOLIDS TO DISPOSAL
SOLIDS TO DISPOSAL
VACUUM FILTER
CHROMIUM 0.1 mg/l
COPPER 0.1 mg/l
LEAD 0.1 mg/l
NICKEL 0.1 mg/l
ZINC 0.1 mg/l
pH 6-9
FLOW=SEE TABLE XIII-1

(1) ALTERNATE RECYCLE LOCATION FOR PIPE & TUBE OPERATIONS

(2) RECYCLE PERCENTAGE
:50% FOR PRIMARY, SECTION, AND PIPE & TUBE
:30% FOR FLAT OPERATIONS

(3) SYSTEM RECYCLE RATE IS INCREASED TO ACHIEVE AN OVERALL RECYCLE RATE OF 96%

ENVIRONMENTAL PROTECTION AGENCY

STEEL INDUSTRY STUDY
HOT FORMING SUBCATEGORY
PRETREATMENT MODEL

Dwn 2/15/80

FIGURE XIII-1